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PLANT DEPRECIATION.

The paper by Mr. Wilkinson, abstracted in this issue, on the depreciation of electrical plants and telephone exchanges presents a number of interesting points for consideration, and we can commend it for careful perusal. It has not been the custom among electrical people to regard lighting, power and telephonic systems from the same standpoint, but Mr. Wilkinson reminded his hearers that the distributing plant of poles, wires, etc., is in most of them pretty much the same, and subject to the same conditions of superannuation. With respect to the interior plant—that of the generators or the telephone central—Mr. Wilkinson again finds a curious similarity in the rate of depreciation, and puts it at the all-around figure of 10 per cent per annum. It would be interesting to know how many local lighting or local telephone companies write off at that rate. None too many, we fear, especially among the newcomers, and certainly very few of the municipal plants. Some of these avowedly disdain taking account of depreciation.

CHARGING FOR CURRENT.

We are keenly interested in the matter of central station charges which is at present so frequent a subject of active discussion, and hope eventually to see order come out of chaos and a definite line of practice generally adopted. Electric lighting, however, started out on a system of charges quite novel in commercial affairs of a related kind, and chaos seems to be the penalty of reform. The flat rate, which virtually said to the consumer, to paraphrase a bit: "Use as many lamps as you please—we will contract to keep you in oil at so much per month," was not only unscientific, but also uncommercial, and was doomed to replacement as soon as electric lighting got finally upon a business basis. It soon got complicated, too, for the man who used lights in his home evidently was paying a most outrageous price for them as compared with the man who was lighting his factory. The logical step towards reform was payment by meter on a simple, regular schedule with a sliding scale of discounts to large consumers. This corresponded with the long established practice of the gas companies, and was, on the whole, very satisfactory to all parties. But the matter did not rest here, for in different classes of service both the investment of the supply company per light connected and the real cost to the company of energy delivered, varied greatly, and here the trouble began. As regards the first count the gas companies are in exactly the same fix and have made no fuss about it, but their storage capacity changes the situation radically with respect to the cost of service at different hours. The net result has been the introduction of a considerable variety of demand and two-rate systems and modifications thereof, which have been repeatedly discussed in our columns.

These modified systems of charging may be divided, as just intimated, into three groups. The first bases, virtually, the customer's charge on his maximum demand for service, a second on the time at which the demand occurs, and the third on capacity installed in connection with one or the other of the former considerations. In reality the things aimed at are the two variations in cost due to capacity for which the supply station must invest capital, and, second, the variation due to the fact that the cost of energy is subject to a diurnal variation produced by differing conditions of load. The vital question at issue is whether these should be taken care of commercially by general average, or whether they should be allowed for

in each individual case. The gas companies take the former method and appear to be losing no money at it, but as already pointed out, the cost of gas is subject to no material diurnal variation. In facing the second horn of the dilemma one may regard as axiomatic the following facts: First, a customer who demands capacity for 100 lamps and uses ordinarily only 10, throws a burden of capacity on the station. Second, a customer who calls for 100 lamps at the peak of the load also inflicts an undue burden on the station. Third, a customer whose energy is demanded clear of the peak deserves to be encouraged, for he helps the load factor and makes no extra demand for station capacity. The diurnal variation in the cost of energy is a very complicated thing which has never been properly worked out, involving both questions of capacity and efficiency, and the variation of both with the load conditions.

Now, as a practical matter, a charge based purely on maximum demand irrespective of the hour at which it occurs does not tend to improve the conditions of load, and in so far is faulty. A two-rate system, as ordinarily used, tends to flatten the load curve by cutting down the peak instead of by building up the low loads, and a capacity charge in view of the practice of the gas companies always impresses the consumer as pure robbery in spite of any and all explanations. What is really needed is a simple method of encouraging the full use of all lamps installed, and their use at hours off the peak. A two-rate meter fast on light loads would virtually meet the requirements better than most of the more complicated systems of charging, if the customer could ever be brought to appreciate the advantages of its use, but we fear that the task of popularizing it would be difficult. Perhaps it would take better if described as a two-rate meter slow on heavy loads to encourage the larger user. One of the faults in ordinary methods of selling current is the sliding scale of rates favoring large consumers. In point of fact, a large consumer ought in many instances to pay proportionately more than the small consumer, for the former very often calls for his full capacity on the peak of the load, in which case he is far more of a burden than a group of small users at other hours. Each station has its own little peculiarities in such matters, but we greatly doubt whether the maximum demand system, the two-rate system or any of their modifications, will in the average station give more uniform satisfaction than a straight-forward, old-fashioned meter system with a special discount for load taken at hours clear of the peak. The best way of building up the load curve is by filling its hollows. A motor load can be made particularly useful in this connection, and a liberal discount will pick up a good many customers willing to take their power, or the most of it, at times which will not build up the peak. The tact of the station manager can get results not to be guaranteed by any meter system whatever, and a thorough study of the market will generally be very productive of results. And other things being equal, the simplest system of charging is the best, with all due respect to projected improvements.

Insulation Resistance of Air.

A remarkable paper appears in the Proceedings of the Royal Society for May, 1901, by C. T. R. Wilson, in which experiments are described tending to show that dust-free air is not a perfect insulator at ordinary pressures. It is commonly supposed that if a small body, say, for example, a silver-plated marble, receives an electric charge and is supported in dust-free air by a dry, slender thread, then whatever electricity gradually escapes from the globe goes over the thread and does not go through the surrounding air. In practice, this is what actually occurs for all intents and purposes. In the experiments recited, however, the charged body consisted of a thin brass strip, and an attached gold leaf was fastened to a conducting wire by means of a little bead of sulphur. The wire was maintained artificially at the initial potential of the charge, so that any leakage over the sulphur insulator tended to diminish, and not to increase, the leakage of the charged system. Under these circumstances the position of the gold leaf with respect to the brass plate was determined with the aid of a microscope from time to time, and showed that at a pressure of either 210 volts, or 120 volts, the charged system leaked steadily and that its potential fell at the rate of 4 volts per hour. It is remarkable that the fall of potential was approximately the same at either the higher or the lower potential, and this shows that Ohm's law did not apply to the insulation resistance of the air. If Ohm's law had applied, the hourly fall of potential would have been greater at 210 volts than at 120 volts, and, moreover, it would have followed a logarithmic law at either pressure.

The explanation for the leakage, which is offered, is that about 20 ions are formed per cubic centimetre per second in this air at that pressure and temperature, and these ions, as they form, naturally under mutual collisions of air molecules are brought into action, and made to carry electric charge from the charged conductor. The total rate of discharge cannot then exceed the carrying power of all ions that are being formed, and since the pressure of charge was not sufficient to determine the formation of any extra number of ions, a steady current of discharge was produced independent of the potential of the discharging body. In other words, the air became saturated with electric current just as iron becomes saturated with magnetic current. Of course, the current was exceedingly small, namely, about 1.4×10^{-15} amperes, and the insulation about 10^{17} ohms. The insulation resistance in this case is variable, and the current is constant. Both are functions of the shape of the discharging body and the conditions of its environment. As the pressure of the air surrounding the charged body was artificially reduced, the rate of fall of potential fell in nearly corresponding measure, showing that fewer ions were at work and fewer air molecules at work producing ions.

If these results are reliable, and they seem to be in accordance with those of Geitel, we may say that a charged telephone wire supported on insulators discharges almost entirely by the action of ions present on the surfaces of the insulators, and roughly in accordance with Ohm's law. Also in a very minute degree it discharges by the action of wandering ions always present in the circumambient air. Of course, if the telephone wire is charged to a very high pressure—many kilovolts—then this pressure will be sufficiently great to produce ions out of the neighboring air, or to tear ions out of the neighboring molecules, in which case we obtain the phenomena of the electric breeze, usually accompanied by luminescence. In such a case the discharge by air ions is much more rapid and may greatly exceed the discharge by the ions on the surfaces of the insulators.

Radio-Active Substances.

A very interesting resumé of the knowledge recently acquired of radio-active substances is published in the issue of our esteemed contemporary, *Science*, for July 12. We may add that the "Rapport" of the recent Paris International Physical Congress contains valuable papers on this subject by Becquerel and Curie. This fascinating department of physics is only about five years old, and already a great many interesting facts have been discovered, and several theories advanced for their behavior. Becquerel discovered the rays which bear his name in 1896, and which were emitted by uran-

ium salts. These rays act upon covered photographic plates in their vicinity, and also make gases, such as air, temporarily semi-conducting. Thorium salts were shortly afterwards found to possess similar properties. By careful separation the active radiations were traced to a small residue both of the thorium and of the uranium salts, and one of these active substances has been called radium, having a radio-active activity more than one hundred thousand times greater than that of the original uranium salt in which the effect was discovered. Radium is a very wonderful substance, radium salts being faintly self-luminous by reason of fluorescence engendered by their own radiation. In these salts we seem to have not only light continually emitted without invisible accompanying heat, but we also have both the light and invisible radiation perpetually emitted without the apparent supply of energy to the substance from without.

It seems that the radiation consists, at least in part, of corpuscles or minute particles of matter shot off with enormous velocities from the surface of the active body, and negatively charged. It would appear that the atoms of the active substance are slowly breaking down, and ions or negatively charged chips from the atoms are being shot off into their surrounding space. These negative ions not only have the power of chemically affecting sensitive substances in their immediate vicinity by molecular bombardment, as in the case of sensitve photographic films, but they can knock chips off molecules of air or other gas which they strike in their passage; hence the neighboring air becomes temporarily ionized or semi-conducting. The Becquerel rays emitted from radium and certain of its salts seem therefore to be at least partly composed of streams of excessively minute negatively charged portions of matter, which are speedily arrested and intercepted by matter placed in their path, either in the form of a solid sheet or even in the form of a layer of gas. The surface activity of these active salts is extremely feeble, amounting in the case of very actively radiating material to about 5 ergs per second, or half a microwatt per square centimeter of the active surface. The rate of decomposition of the salt into ions, or the loss of matter in radiated ions, is estimated to amount to about one microgramme in a million years. Consequently the total amount of energy which we can obtain in the form of light from a substance of this kind without supplying external energy to it is extremely minute, and the stock of energy from which the light comes is supposed to be the atomic or chemical potential energy of the substance. The radio-active substance tends to acquire a positive charge by reason of the separation and shooting off of negatively charged ions from its surface. The ions shot off tend, on the other hand, to communicate a negative charge to the substances which they hit. In these facts and hypotheses we see revived the ghost of Le Sage's theory of gravitation and of Newton's emission theory of light, which latter Young's undulatory theory long ago destroyed and buried.

From the standpoint of these hypotheses, which at present appear to coincide fairly well with the observed facts, the Becquerel rays, or a part of them, are similar to the cathode rays inside a Crookes' tube. Like them, they are deflected both by magnetic and electric fluxes. The Becquerel rays are, however, shown to be far from homogeneous, and also to contain other types of rays which do not appear to be negatively charged bodies, or do not seem to be acted upon by e. m. f.'s. It is thought that perhaps these rays may be secondary rays, like Röntgen rays in ether, set up by the ionic bombardment streams, just as Röntgen rays are known to be the offspring of cathode rays at the places where the latter impinge upon an interposed surface, such as the glass walls of a Crookes' tube. In this direction of research there seems to be enough material to keep all workers busy who may apply for occupation for many years to come.

A supposition has been formed that all matter may perhaps be composed of a simple fundamental substance called protyle, and that the various atoms of different substances involve different arrangements or structural conditions of protyle. In the completed form of atomic construction, matter differs in its properties as known by chemists, but if the atoms of any substance can be split up into negative ions or corpuscles, those corpuscles are again the primitive protyle. In gases and liquids it is known that the constant collisions of neighboring atoms or molecules gives rise to electrical dissociation or ionization. Thus, in free air, it has been estimated that there are about 20 ions per cubic centimeter, at normal temperature and pressure, and in an aqueous solution of common salt most of the molecules of the salt are believed to be ionized. It now appears, from the Becquerel phenomena, that in certain kinds of solid substances, the same atomic attrition, erosion and splitting up is constantly going on. Accompanying the splitting up there is a constant tendency to recombination or reunion of ions, both in solids, liquids and gases. But the electrical conductivity of liquids and gases is attributable entirely to free ions which begin to move along the electrostatic flux line under the influence of a difference of electric potential, the positive ions marching down stream, and the negative ions, or chips, up stream. Each ion carries, as its inseparable accompaniment a definite ionic charge of electricity. It is supposed that the negative ions are the chips or little corpuscles torn from an atom by bombardment, while the remainder of the atom from which a chip has been torn is the positive ion; consequently, there is a distinct difference between the behavior and speed of motion of the little negative chip ions, and the relatively far more massive positive atom ions.

If air had the same number of free atoms in it per cubic centimetre, as an electrolytic solution of a salt, such as sodium chloride solution, then air would be even a better conductor than the electrolytic solution, since the ions could move more freely through gaseous air than through the liquid water. The fact that air is so good a non-conductor at ordinary temperatures and pressures is due, partly, to the crowding of the molecules and their impediment to the movements of ions, but mainly to the fact that normally there are so few free ions in ordinary air. More ions can be produced in air, either by Röntgen or cathode rays, or by ultra-violet light, or by the presence of an incandescent filament, or by Becquerel rays, or by powerful electromotive intensities and electrostatic forces—all of which tend to knock chips off the air molecules. If the above hypotheses are correct, and, of course, they are still largely unsupported by sufficient evidence to make them gospel, it would seem that the only conditions under which protyle is manufactured—the first step towards the transmutation of substances—is in the Crookes' tube under violent electrostatic stress, or in ordinary matter, solid, liquid or gaseous, under the influence of the collisions of its constituent molecules. In each case the quantity of protyle seems to be ridiculously small, so that there is no immediate prospect of being able to gather it up and control its rebuilding into any desired atomic condition. Moreover, atomic rebuilding into the existing neighboring atomic condition seems to go on automatically by recombination, thus limiting the extent of the dissociating action. It must be confessed that the immediate prospects of manufacturing gold or platinum from protyle derived from some other substance are not very promising.

Jury of Electrical Awards for the Pan-American.

Dr. Henry Pritchett, superintendent of awards at the Pan-American Exposition, has announced as jurors in the department of electrical exhibits: Carl Hering, chairman; F. B. Crocker, A. V. Abbott, D. C. Jackson, W. S. Franklin, W. S. Barstow, W. E. Goldsborough, A. E. Kennelly, Henry S. Carhart and William L. Puffer.

The electrical exhibits at the Pan-American, though not great in volume, are in many respects choice and interesting as representing the latest development of the art. Professor George F. Sever, superintendent of this department, deserves considerable credit for the way in which he has brought together such a collection at a time when factories are so busy that they can hardly turn out goods to fill orders, let alone exhibit material.

Now that the jury work has begun, no time will be lost in pushing it to completion. It will be taken up actively this week, and a number of the jurors are already on the ground, so that they have been able in many sections or groups to effect an organization.

Electrical Engineers of the Day—IV.

E. W. RICE, JR.

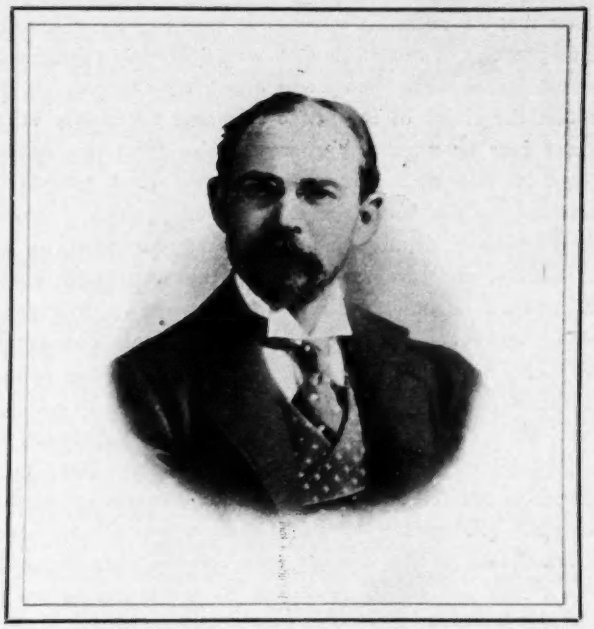
In the year 1880 Edwin William Rice was called upon to make that momentous decision which so many young Americans have to make. He had just been graduated with first honors in his class in the Central High School of Philadelphia. Two years previous to this time he had attracted the attention of Professor Elihu Thomson, who then taught chemistry and mechanics in the High School, by his skillful amateur work in constructing telephones, telegraphs, electrical machines, induction coils and small dynamos. Then the pupil fairly won the master's heart by his success in grinding and polishing glass specula and in silvering them by a new method orally communicated to him—a rare enough feat, even after seeing it done many times.

Thus it happened that young Rice had free access to the shop behind the baker's store where the earliest Thomson-Houston arc-light machines were being constructed, and thus it happened that in the summer of 1880 he was forced to choose whether he should go through college with the prospect of a career which bade fair to be distinguished, or attach himself and his fortunes to the then infant industry of electric arc lighting. With that coolness of judgment which has always continued to be one of his distinguishing characteristics, Mr. Rice turned his eyes resolutely away from the attractions which a college course presented, and became Professor Thomson's assistant and confidant in the American Electric Company at New Britain, Conn., then newly formed to manufacture arc-light apparatus under the Thomson-Houston patents.

The two years that followed, while fruitful in technical development, were far from showing the business prosperity in the new enterprise which had been anticipated, and Mr. Rice, while acting as practically foreman of the electrical works, found time to wind armatures and otherwise to acquaint himself thoroughly with manufacturing details. The clouds lifted in the fall of 1882, when Messrs. A. A. Pevear and Silas A. Barton came from Lynn to buy a lighting plant, and ended by buying a majority interest in the stock of the American Electric Company, which they transferred to Lynn and renamed the Thomson-Houston Electric Company. Then followed two or three delightful years during which Mr. Rice was permitted to devote his energies to experiment and invention, and during which his name began to be familiar in the Patent Office, often in conjunction with Professor Thomson's, for radical improvements in the electrical art, though chiefly at this time in arc-lighting systems.

By 1885 the business acumen of Mr. C. A. Coffin, who had become associated with Messrs. Pevear and Barton, on the removal of the works to Lynn had begun to make itself felt in every direction, and the enterprise was growing with surprising rapidity. Under these circumstances the need of a superintendent of the works with an adequate technical knowledge of electricity began to be acutely felt, and Mr. Rice, though still considerably under 30 years of age, was asked to accept this position. If he hesitated for a moment it was chiefly because his new field of labor would tend to break the chain of close association which had hitherto bound him to Professor Thomson. A short trial of the new duties was sufficient to show those about Mr. Rice that he was the right man for the place, and also to convince him that his new responsibilities would not necessarily impair his fertility as an inventor. Under his able and tactful management work was systematized, production hastened and costs cut down. To constant-current arc lighting were quickly added motor work, constant-potential incandescent work, and railway work, while the alternating-current transformer system of lighting was developed. Of all this expansion, Mr. Rice was keenly a part, growing as the work grew, keeping abreast of the world's rapid progress in electrical science, and, in spite of his heavy daily task as superintendent, seldom missing an opportunity to transmute new theories into practical inventions.

From a few hundred men who were employed in the Thomson-Houston factory at Lynn when Mr. Rice took charge in 1885, the number of hands had grown until 3700 were at work in 1892, when the next great change in his career took place—the Thomson-Houston and Edison General Electric companies being consolidated into a new concern known thereafter as the General Electric Company, with Mr. C. A. Coffin as president and Mr. Rice as technical director. To follow his career after 1893 would be to write a history of the technical development of the General Electric Company. From technical director he was promoted to be chief engineer, and on June 26, 1896, he was elected to the office, which he now holds, of third



vice-president of the company, in charge of all its technical and manufacturing departments.

It is worth while to look back upon the large and varied experience which Mr. Rice has had in the electrical field during the past 16 years which he has been engaged, not in a subordinate capacity but in positions where his word counted with that of only nine or ten other men in the world in picking out the path of least resistance for the advance of electricity in the arts. He has seen the flexibility of the arc lamp developed to meet almost every condition of electrical circuit. The responsibility for making the crucial experiment of the West End Street Railway, of Boston, an electrical and mechanical success fell upon his shoulders. He has furthered the growth of long-distance electrical transmission of power, with its many difficult problems about which the non-technical world knows nothing, and the technical world not directly interested little more. He has followed closely the electrical and mechanical development of the polyphase motor, and has personally done much to insure its successful operation in driving textile and other classes of mills. He has attacked successfully the weak point in distributing systems of polyphase currents of large volume at high voltage by the invention of an oil switch—the cellular switch— and a switching system at once safe and simple. And he has provided a means by which alternating current may be used for mixed lighting and power circuits with constant voltage automatically regulated. As for the rest of his inventive work, it is partially indicated in the statement that he has been granted more than 100 patents. While himself thus fertile as an inventor, he also possesses the valuable faculty of directing the inventive ability of others to meet the cases constantly arising in the industrial development of the art.

Mr. Rice is a member of the American Institute of Electrical Engineers and of the American Association for the Advancement of Science in this country, and is a member of the Institution of Civil Engineers and of the Institution of Electrical Engineers in Great Britain. After the Paris Exposition last year he was created a Chevalier of the Legion of Honor.

The Electrical Plant of a Philadelphia Newspaper.

By J. H. VAIL.

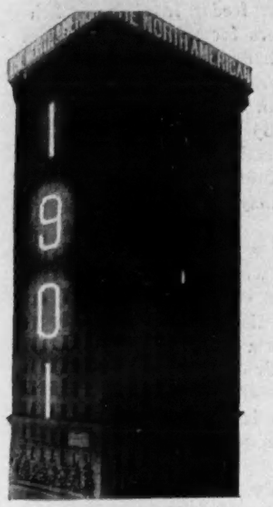


FIG. 1.—NORTH AMERICAN BUILDING.

THE *North American*, the oldest newspaper in America, was founded in 1771. In May, 1899, the publication was acquired by the present owner, from which date it entered upon a new journalistic career. As with all successful newspapers the old quarters and old equipment quickly proved inadequate. The phenomenal development quickly made necessary a new publication headquarters, and now towering above all the other buildings in the city of Philadelphia, at the corner of Broad and Sansom Streets, we find not only the finest office building in Pennsylvania, but also a complete typical equipment in the home of one of the greatest newspapers in the world.

In its architectural design the North American Building is worthy of more than usual notice. The new building covers a ground area of 76 ft. by 104 ft. It has two stories below grade line and 21 above grade line. The total height from foundation to roof is 296 ft., and above grade line, 256 ft. The limited ground area upon which the building has been erected made somewhat difficult the problem of arranging in a convenient manner all the mechanical, steam and electrical apparatus necessary for the equipment of the entire plant. Unique architectural work in designing the sub-structure was necessary to prevent damage to the tall office building of the Real Estate Trust Company on the adjoining property.

The excavations were carried to a depth of 40 ft. below grade line, finding a good gravel bottom at about the level of low tide in the Delaware River. The entire ground space is overlaid with a high grade of concrete to a depth of from 5 ft. to 15 ft., and literally interlaced with heavy structural steel grilling under all walls and columns. All foundations of engines are free from contact with walls and columns.

Heavy arched brick foundation walls were considered absolutely necessary by the manufacturers to support the Hoe sextuple presses in the basement above the engine room, which reduced the available floor area and limited the head room, making the problem of a plant installation most difficult and involved. The balance wheels of the larger engine clear these press supports about 1½ inches.

Excellent ventilation is secured at all requisite locations by motor driven fans introducing fresh and exhausting impure air, the total capacity of the motors used for this purpose being 38½ horse-power. Cold air is forced into and the impure air is exhausted from the engine room, which, though in the sub-basement, is maintained at a very comfortable working temperature.

Steam is generated by four 300-hp water-tube boilers built by the Edgemoor Iron Works, to carry a working pressure of 135 lbs. per square inch. The chimney is of steel plates lined with brick, the ipternal diameter being 5 ft. 9 inches, and the height 300 ft. The draft is more than sufficient, and is regulated by an automatic damper regulator, controlling a large damper in the main flue.

The ash pits are suspended hoppers of heavy steel plate, lined with a course of firebrick to prevent the hot ashes from warping the plates. Each hopper is provided with a vizor gate opened by segment gears for discharging the contents to proper receptacles; the latter are arranged to be hoisted to the ash cart by an electric hoist.

The actual coal storage space is comparatively small, but is utilized to the full limit of the available space, giving about 75 tons capacity. The coal conveying and ash handling apparatus were installed by the Link-Belt Engineering Company.

The water supply to the boilers is furnished by three boiler feed pumps, each capable of delivering at normal speed 2000 gallons of water per hour. One of these pumps is a duplex Worthington steam pump, and two are triplex pumps motor-driven. Any one or all of the pumps is capable of working to an overload capacity of 50 per cent. Other large pumps are provided for elevators, fire protection, house service, drainage, etc.

During warm weather the exhaust steam is discharged to the atmosphere through the vertical exhaust pipe leading above the roof of the building, and during the cold season the exhaust is used for heating by the Warren Webster vacuum system.

Side crank engines of the well-known Porter-Allen type are used for driving the generators. A sub-base extension is provided, fitted to receive direct-connected, direct-current, slow-speed generators. The present equipment consists of one engine of 150 horse-power, driving an electric generator of 100-kw capacity, and two engines each of 300 horse-power, each engine driving an electric generator of 200-kw capacity. Space is allowed for a third 200-kw unit as reserve.

The electric generators are of the direct-current, direct-connected multipolar type, manufactured by the Crocker-Wheeler Electric Company, and have a total capacity of 500 kilowatts, divided as above described. The generators are over-compounded for automatic regulation to compensate for the loss in the system of distribution, and are connected to work independently or in multiple with each other as required. The field frame of each generator is fitted and mounted on the extension base of its engine, and because of limited head room is divided vertically to open on a horizontal plane at right angles to the shaft, giving convenient access for repairs to the field coils and armature windings.

The current generated at the dynamos is conducted to the switchboard by heavy cables laid in vitrified conduits below the engine-room floor. The switchboard is erected within convenient working

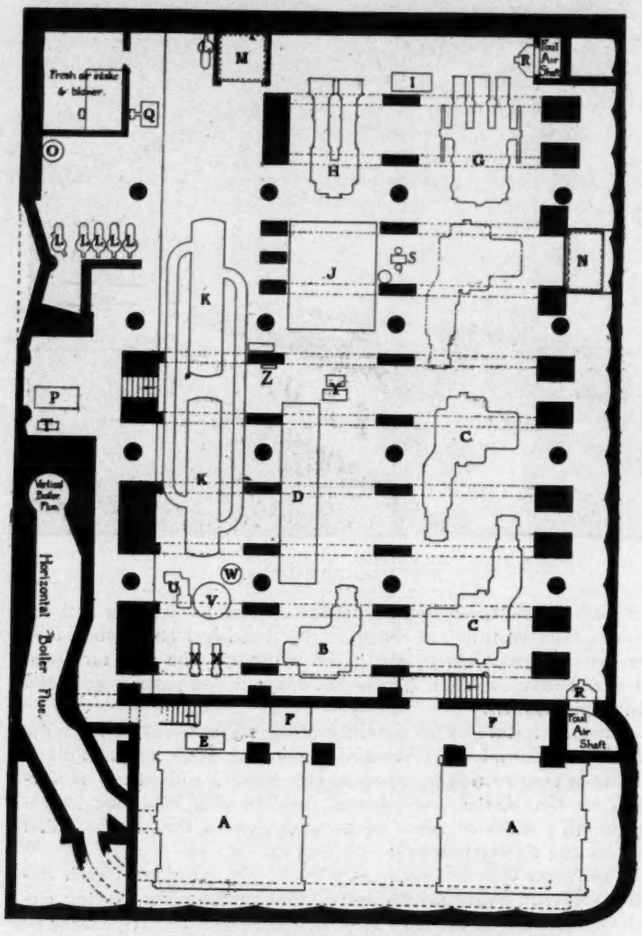


FIG. 2.—PLAN OF ENGINE ROOM FLOOR.

A.—Two 300-hp Edgemoor Return Tubular Boilers B.—100-kw C. & W. Generator, d. c. to 150-hp P-A Engine. C.—200-kw C. & W. Generator, d. c. to 300-hp P.-A. Engine. D.—Switchboard. E.—Boiler-feed Duplex Steam Pump. F.—Boiler-feed Triplex Motor Driven Pump. G.—Laidlaw-Dunn-Gordon Pumping Engine. H.—Worthington Pumping Engine. I.—Worthington High Duty Duplex Engine. J.—Discharge Tank. K.—Pressure Tank. L.—Elevator Cylinders (vertical). M.—Freight Elevator. N.—Pavement Hoist. O.—Adams Sewage Lift. P.—Hot-Water Generator. Q.—Motor, Driving Blower. R.—Motor, Driving Fans, Expelling Vitiated Air. S.—Westinghouse Air-Compressors and Tank. T.—Ice-water Pump. U.—Motor-driven Ice-water Engine. V.—Ice-water Tank. W.—Condenser. X.—Vacuum Pump. Y.—Pump and Receiver for Bilge Tank. Z.—Ejector.

distance of the generators. The frame is of structural steel angles and channels bolted and riveted together. The panels are of Vermont marble slabs, 1½ inches in thickness, having a ⅜ bevel around the face corners, polished on both sides and all edges and bevels. There are four generator panels, and six feeder panels, the instruments for two feeders being mounted on each panel. The rear of the switchboard is protected by a substantial iron frame and grille work, with a door at each end affording convenient access to a rear passage 3½ ft. wide for inspection, and cleaning of the electrical conductors, connections and apparatus. Each generator panel is fitted with a pilot lamp, a Thomson recording wattmeter, and G. E. astatic voltmeter and ammeter; a double-pole quick break double-throw knife blade switch, automatic circuit breaker, rheostat and enclosed safety fuses. Each feeder panel is fitted with an ammeter, recording wattmeter, double-pole automatic circuit breaker, double-pole double-throw quick-break switch, and double-pole enclosed safety fuses. In an installation for this kind of service the circuit breaker on each feeder is found very useful and satisfactory by the operatives.

The switchboard is equipped with a double set of bus-bars for the generators, a bus for power feeders, and one for lighting feeders. The double-throw switches previously mentioned make it convenient to use one or more generators for power or for lighting each independent of the other.

The arrangement of recording wattmeters affords facilities for keeping an accurate record of the energy from each generator, and also to separate the accounts of current used for lighting and for power. The switchboard complete was furnished and installed by the General Incandescent Arc Light Company, who also furnished all push-button switches, receptacles, outlet boxes, panel boards and distribution panels.

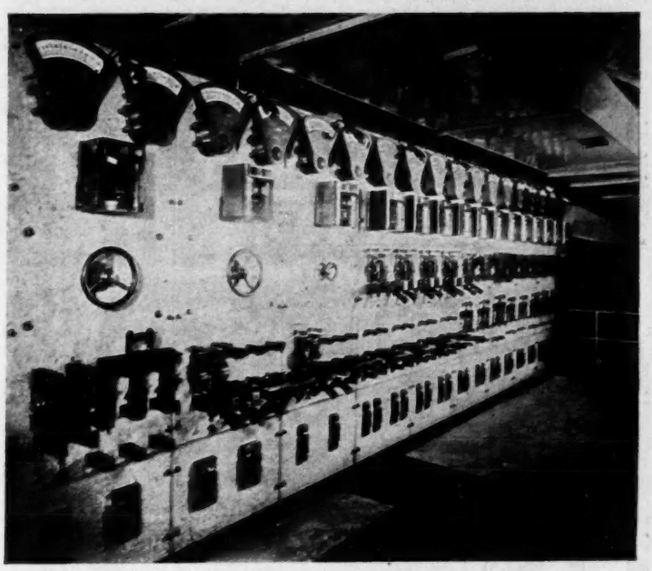


FIG. 3.—SWITCHBOARD.

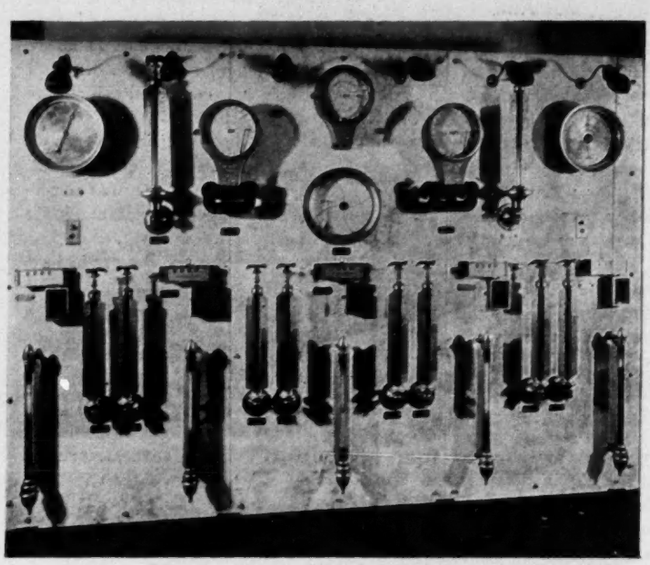


FIG. 4.—SIGNAL BOARD.

A unique feature of great utility is the signal board in the office of the superintendent of the building in the third story. This is similar in construction to the usual switchboard, with panels of Vermont marble. On this are located the following indicating instruments with wires or pipes connecting between the several initial sources and the instruments:

Glass water column indicators, showing the position of each elevator. Mercury columns, showing water pressure for moving elevators. Mechanical counters indicating the number of trips made by each elevator. Glass water column indicators showing the water in storage tanks. Steam gauges indicating steam pressure, and recording steam gauges showing variations of pressure of live steam, also on steam-heating system. Recording ammeters showing amount and variations of current used, and recording voltmeters indicating e. m. f. A thermometer indicating temperature of drinking water.

The wiring of the building is for 220 volts on the two-wire system. The arrangement of feeders is an improvement over that usually employed in large business buildings. The height of the building and the large amount of current required for the several departments in lighting and power demanded an unusual economy in copper as well as a system of electrical distribution possessing such sub-divisions as would in every degree have the element of flexibility and reliability. These objects have been attained by the system of electrical distribution illustrated in the diagram, Fig. 5.

The feeder system consists of a power feeder from the switchboard to the twentieth floor. Five feeders for the lighting system to offices. One feeder for lighting of halls, corridors, stairs and toilets. Five feeders, one to each of the printing presses. Two auxiliary feeders from switchboard to twentieth floor and paralleling each of the previously mentioned feeders. By the use of double-pole double-throw switches at branch-off connections either of these auxiliary feeders may be utilized as a substitute for either of the lighting feeders, or for the power feeder, or may reinforce any or all of the feeders, as occasion requires.

The floors are grouped on five sets of vertical mains for electric lighting. Each vertical main is supplied with current by the feeder leading from the respective feeder panel on the switchboard, and through the wire shaft to the center of distribution of the vertical main. At the switchboard panel there is a double-pole quick-break switch, an automatic circuit breaker, a pair of enclosed safety fuses; at the extreme end of the feeder a double-throw quick-break switch is provided, so that in the event of its feeder being out of order the load of this section of the building can be quickly transferred to the auxiliary feeder.

The electrical distribution for each floor is obtained by a system of enameled iron conduits through which are drawn stranded copper conductors furnished by the Standard Underground Cable Company. Each conductor is highly insulated with rubber insulation protected by heavy braiding.

On each floor there are located at convenient points, distributing panels, each panel being of Vermont marble enclosed in a heavy sheet steel box, the sides, top and bottom also lined with Vermont marble. A bevel plate glass panel in a metal door frame with lock and key protects the panel. All of the switches and conductors in the panel boxes are of highly polished copper insulated with Sterling transparent varnish, excepting at the contact parts where the metal has a carefully faced contact surface.

The different offices are fitted with electroliers, side brackets and numerous receptacles for attaching desk lamps. The electroliers are controlled by push-button switches set flush with the surface of the wall.

The printing press equipment now consists of five sextuple color combination presses built by R. Hoe & Co., with space reserved for a sixth press. Each press weighs 60 tons and requires a floor space of 10 ft. wide by 24 ft. long, and a height of 13 ft. The arrangement of the pressroom floor is shown in Fig. 6.

Running at full speed the six presses will use thirty-eight rolls of paper an hour, aggregating 300 miles, transforming the same into 288,000 papers of 12 pages each. Four thousand eight hundred lbs. of ink are required to fill the fountains for a run. About 14,000 lbs. of stereotype metal are used for the plates, which have an area of 576 square feet.

The mechanical and electrical work has reached such a stage of perfection that it is a remarkable fact that in the production of the *North American* no human hand is required to touch the material composing the pages of the paper from the moment the logs are felled to make the pulp until the printed sheet is delivered to the carrier.

Under each press is a pit, the floor and walls of which are laid in white enameled tile. At the side of each press below the floor is formed an enclosed chamber of steel plate, in which is set the motor-driving equipment. The motors are cooled by a blast of cold air from one of the motor-driven blowers elsewhere described. Trap doors are so arranged on the pressroom floor that when opened convenient access is afforded to each motor and teaser. Either machine can readily be disconnected and lifted out of its position, or an armature can be replaced with the minimum of labor.

Each press is driven by a 50-hp Bullock motor with teaser and booster. A switchboard and controller is provided to operate the motor equipment of each press, as seen in Fig. 7, which also shows a portion of one press with trap doors removed showing the motor and teaser.

The success of the Bullock power system as applied to large printing presses is largely due to the manner in which the electric current is supplied to the motor in accomplishing perfect control and excellent economy of current. With this installation in the North American Building, and by the use of the teaser, the starting current is but momentarily about 40 per cent above the current at full load. Remarkable steadiness of operation is attained under slow speed, and there is no uneven or jerking movement of the press, which in some instances is found liable to break the web of the paper.

The illustration shows the driving motor direct connected to the press, and its speed is under absolute control of the operator, who can, by the movement of a hand-wheel, start the press in exceedingly slow motion, moving it along inch by inch with the greatest ease, and bring it up to a regular slow motion and then to any speed required in the operation of the press. Push-buttons are placed at convenient points about the press by the use of any one of which the press may be immediately stopped.

Each printing press is lighted by 20 incandescent lamps fixed at suitable points and protected with wire guards. The conductors are enclosed in enameled iron conduit. The pressroom is lighted by 15 enclosed arc lamps as well as incandescent lamps distributed at desirable points.

The art department on the twentieth floor is furnished with a special panel box and switch panel for distributing current to the special projecting arc lamps for photographic work.

In the finest composing room in the United States the 30 Mergenthaler linotype machines, almost human in their perfection of motion, are operated by individual motors mounted on a frame and connected by a worm-gear reduction. The controlling and regulating devices are mounted on the machine at a point convenient for the operator. The forms are raised from the composing room on the nineteenth floor by elevator to the electrotype room on the twentieth floor, slid swiftly on trucks to the steam bed, where the soft matrix is applied and the usual process of casting is completed. In less than a minute the heavy plate is taken from the mould and passed to the cutting, trimming and planing machines, all driven by individual electric motors, and with a few finishing touches it is sent to another elevator and descends 21 stories to the pressroom at a speed of 600 ft. per minute.

In the engraving department the cameras have the benefit of a large volume of light from several powerful arc lamps, concentrated on the subject to be illustrated. In this department a half-tone can be made ready for the press in a little over 30 minutes.

In the interests of economy and convenience of operation the liberal use of electric motors is one of the most prominent features in the electrical equipment of the North American Building. The following is a schedule of motor applications:

Five Hoe sextuple presses, each driven by a 50-hp Bullock motor and teaser; form hoist, 2 horse-power; refrigerating apparatus, 7 horse-power; ash hoist, 3 horse-power; coal conveyor, 5 horse-power; ventilating fans, one motor of 4 horse-power, four of 5 horse-power, one of 12 horse-power, two of 2 horse-power, and one of 1½ horse-power; two curved shaving machines, each with a 4-hp motor, direct connected; three cutting off cylinders, 4-hp each, geared; one matrix-rolling machine, 4-hp each, direct connected; one saw trimmer, ½-hp, belted; one screw-driven shaving machine, 3-hp, belted; one

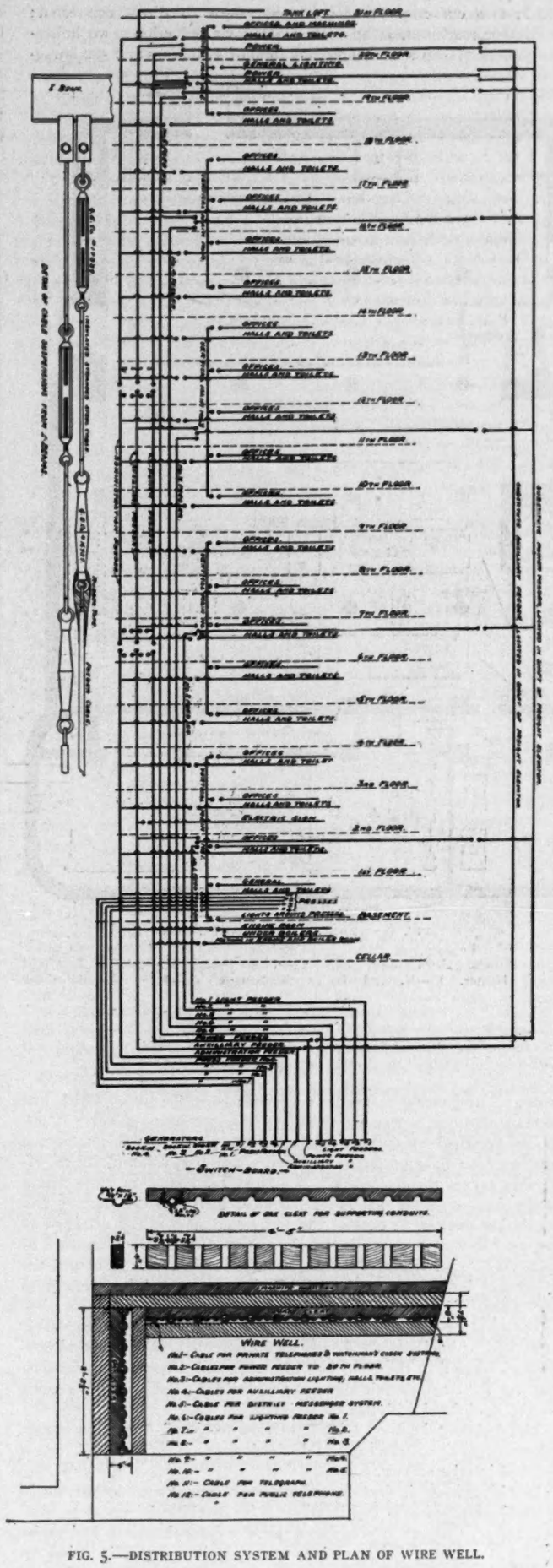


FIG. 5.—DISTRIBUTION SYSTEM AND PLAN OF WIRE WELL.

electrotype-curving machine, 2-hp, belted; one saw table, 1-hp, belted; two curved routing machines, 2-hp each, direct connected; 30 linotype machines, ⅓-hp each, worm-gear reduction; two boiler-feed pumps, 7½-hp each, geared. A total of 52 motors and 372 horse-power. Three more presses are contemplated in the future which will increase the total power equipment to fully 520 horse-power.

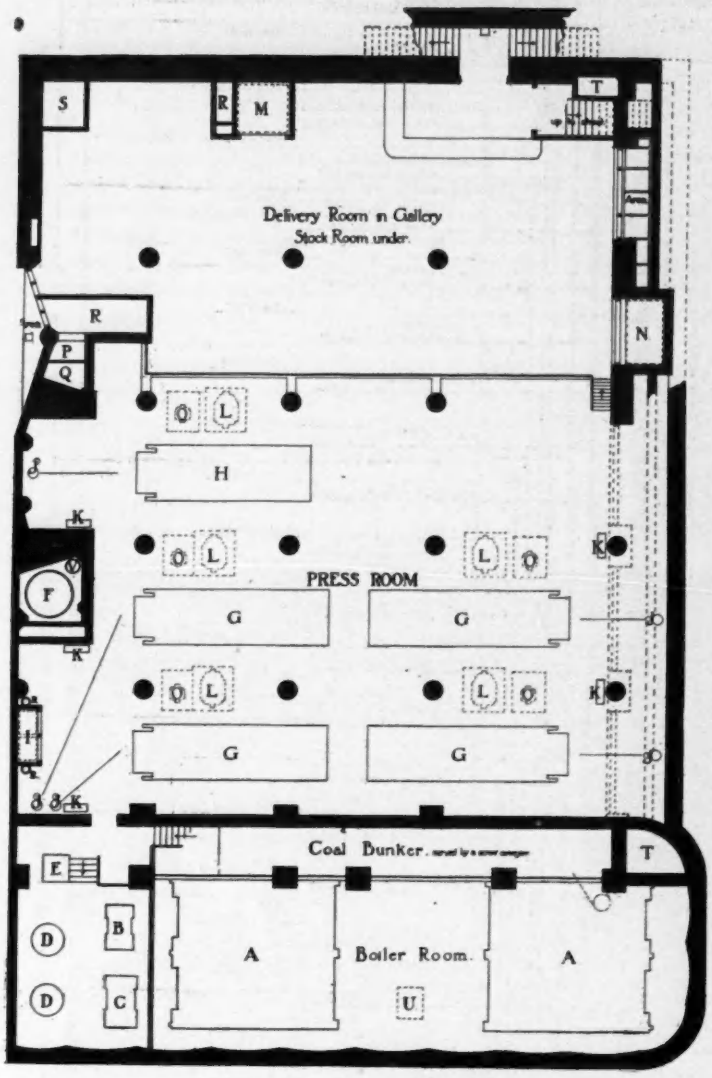


FIG. 6.—PLAN OF PRESSROOM FLOOR.

A.—Boilers. B.—House Pump. C.—Fire Pump. D.—Filters. E.—Feed Water Heater. F.—Vertical Boiler Smokestack. G.—Hoe Sextuple Color Press. H.—Hoe Sextuple Press. I.—Plate Hoists. J.—Paper Rigger. K.—Controller. L.—Bullock Motor, under floor. M.—Freight Elevator. N.—Pavement Hoist. O.—Bullock Teaser Motor, under floor. P.—Wire-well. Q.—Pipe-shaft. R.—Elevator Machinery. S.—Fresh Air Intake. T.—Foul Air Vent. U.—Ash Lift. V.—Vertical Steam Exhaust.

The electrical conductors leading to the motors on the numerous machines are fully protected by flexible armored conduit, which admirably serves the purpose, its flexibility permitting of close fitting to the frames of the machines. In most instances the starting and regulating devices to control the individual motors are attached to the machines at a convenient point. The peculiar requirements of each class of machine were necessarily worked out to obtain the successful individual application of the motor and its method of regulation.

The total number of incandescent lights in the building aggregates 3100, and of enclosed arc lamps 30. There is a special set of conductors leading to the front balcony on Broad Street to furnish current for the large electric sign. An additional electric sign is erected on the roof fitted with 2240 8-cp lamps.

The building is fitted with a private telephone system, a public telephone system, telegraph and district messenger systems, and a pneumatic tube service.

Drinking water is first filtered and then refrigerated by the use of a small ammonia tank and Remington ice machine driven by an electric motor, through which the water can be reduced to and maintained at a low temperature between 35 and 50 degs. F. After refrigeration the water is maintained in constant circulation through a separate system of piping by a small pump in series with the circulating pipes. Cold water faucets are located over each wash basin in the offices on each floor. This system is economical and saves the great annoyance caused by the use of individual water coolers, and the daily supply of ice to individual tenants of offices. The temperature of the fresh and refrigerated water is indicated by thermometers at suitable points.

Mr. James H. Windrim was the architect of the building. The builders were Messrs. Doyle & Doak. The engineers were Mr. J. H. Vail for the electrical and mechanical equipments, and Mr. Henry Adams, heating and ventilation. The steam, electrical and mechanical equipment was erected under the supervision of Mr. B. B. Hough, superintendent of the building.

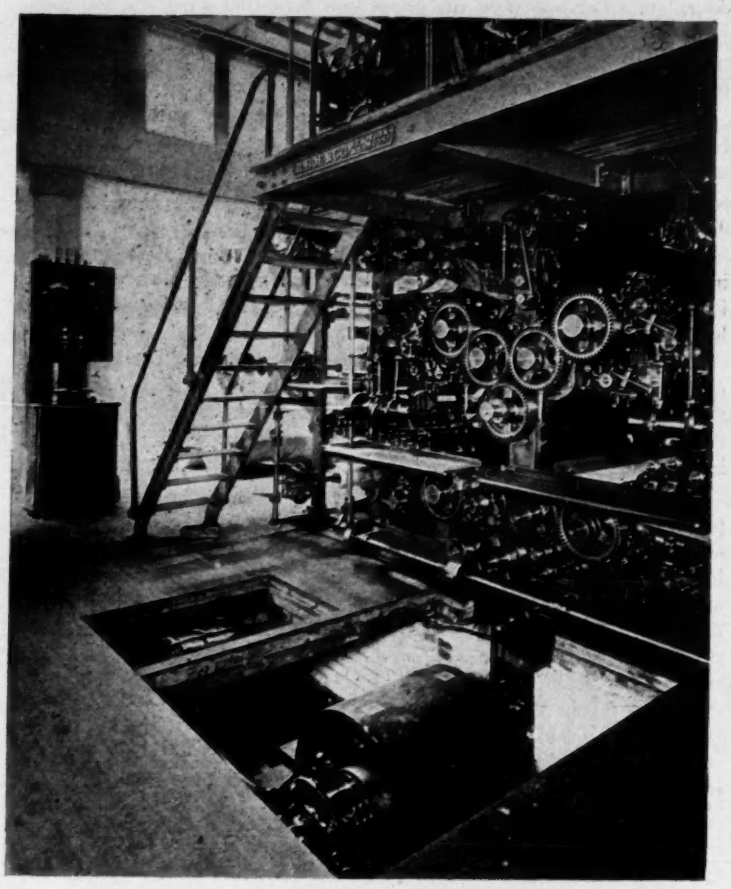


FIG. 7.—PRESS EQUIPMENT.

"Let Me Use Your Telephone."

The question of the propriety of allowing some one else to use your telephone is brought up in a new form by the New York *Sun*, as follows: A new disadvantage in renting one's house for the summer has been discovered by a man who has one of the most attractive houses on Long Island Sound. It is a show place, and the owner's name is always associated with it. He rented the place furnished this summer, and several weeks ago an excursion party was stranded in the neighborhood. It was necessary to procure cabs to take them to the nearest railroad station, which was about four miles away. The leader of the party went to this house and asked permission to telephone for cabs. He was informed that it was a private house, and that his request to use the telephone was an impertinence. He tried to explain the emergency, but he was ordered off the grounds. When he told the members of his party of his experience they were thoroughly angry. After tramping to the station they asked the name of the man who owned the house, and when they heard it several of them knew who the man was. They spread the story, and within a week it had reached the ears of the owner of the place. Of course, he was not responsible for the action of his tenant, but he has been very much annoyed, because he was charged with declining the use of his telephone in such an emergency.

The Slight Use of Automatic or Machine Telegraphy.

BY EDWARD A. CALAHAN.

THE question, "Why machine telegraphy has not been more generally adopted in America?" has been asked me many times, no doubt from the fact of my early experience in that branch of the art, and also that I have followed the improvements and developments with considerable interest up to the present time. I, therefore, have concluded to venture an opinion as to the causes.

The "Bain" was the first telegraph of the automatic class, and was practically used in this country in 1848 and 1849, but to a very limited extent. It was finally abandoned through want of a practical perforator, none having been invented up to that time. Omitting references to various foreign inventions relating to this subject for the reason that they had never been used or tried in this country, the invention of Bain was followed by that of John P. Humaston. The novelty of this invention was principally in his perforator. The transmitter and receiver were slight improvements on well-known instruments. The perforator consisted of a keyboard and a series or group of punches so arranged with reference to the keyboard that an entire letter of the Morse alphabet was punched by a single movement.

The motive power was obtained by the movement of two pedals worked alternately by each foot after each key representing a Morse letter was depressed. The resistance in punching the single dot "e" or the dots and dashes which made up the "period" was not appreciable. Finger power was not necessary beyond the selection of the keys.

The punches cut square holes in the paper tape, thus, ■ ■ ■. It will readily be seen that the contact brushes would make better and more uniform contacts through square than through round holes. This was proven in many tests on the lines of the American Telegraph Company.

The capacity of the perforator was limited to the skill of the operator, comparing favorably with the speed of the typewriter of to-day. The square hole did not always clear itself, and it was as necessary to read over and correct the punched slip before transmitting as it was to translate it at the receiving end. With the slip carefully punched and doctored, 600 words per minute were frequently transmitted from New York and received in Boston in readable condition.

The American Telegraph Company was under contract to purchase this system. This company and the Western Union consolidated, the latter assuming all contracts made by the former. General Anson Stager, general superintendent of the Western Union Company; Austin F. Park, of Troy, and Hamilton E. Towle, of New York, both civil and mechanical engineers of prominence, were selected as a committee to make the final tests and to decide on the speed most practicable and the value of the system. They started at 600 words per minute on a wire between New York and Boston, and reduced the speed gradually until they reached 300 words per minute, which they decided was the practical speed of the Humaston system. This being far below the Humaston claims, litigation followed, resulting in a verdict for Humaston; the apparatus then becoming the property of the Western Union Company, it was quickly reduced to the scrap heap, and the patents were allowed to expire. Thus ended the first real attempt to inaugurate automatic telegraphy in America.

Having personally managed all the tests of the Humaston system, and knowing from experience the uncertainty of the square perforation in practical use, I devised and patented a perforator, the principal feature of which was a wheel containing hollow-cutting punches arranged in line with the axis of the wheel, and containing the full Morse characters to be punched by one motion. The perforations were round, thus, ● ● ● ● and, therefore, there were no corners to be cleared.

This perforator was never put to practical use, as the subject was not interesting to the Western Union Company, the only telegraph company in the country at that time, all others having been absorbed. Prescott, in his "History, Theory and Practice of the Electric Telegraph," page 135, after commenting on the Bain automatic theory, says: "Let this system be introduced and the imagination revel among marvelous accomplishments as it will, it cannot exceed the actual results which will be obtained. The question which will be at once raised by the reader is, Why, if this is practicable, has it never been accomplished?" This book was published in 1864.

On this subject Mr. Prescott had little more before him than the Bain theory. In his work entitled "Electricity and Electric Telegraph," 1877, with the knowledge of several improved systems, his comments are in noticeable contrast with those of 1864, at which time he was connected with the American Telegraph Company, which company was favorably disposed to an automatic system and would have adopted one but for the consolidation above named.

Two companies with decided improvements on "Bain" have come and gone, not perhaps through any fault in the system *per se*, as much as from other causes. The Automatic Company of the early seventies sold their patent for two or three millions of dollars of another company's stock, which they failed to get after closing up business. The American Rapid Company of the early eighties, notwithstanding that nearly 200 miles were covered to connect New York and Philadelphia, was doing a fine business and about paying its way, when a few Morse men got control, resumed key-working, and burst it up in short order.

The Wheatstone system used so extensively in Europe was started here by the Western Union Telegraph Company more than a decade ago, but has not been extended beyond its original limited district. Even the tape-printing machine of Hughes, with Phelps' improvements, an American product so extensively in use throughout Europe, has never expanded beyond New York, Boston, Philadelphia and Washington—one wire to each place. The Morse key has been the yardstick of carrying capacity in this country. When this limit was reached additional wires were strung, until it is our proud boast that with a much more sparsely settled population we have more length of wire per capita than any other country on earth, every mile representing about $150 of capital stock. This may be a good condition, but it does not hold out much promise for cheap rates.

At the present Morse speed, the limit of lowness has been reached. It cannot be expected that this condition will remain indefinitely, it being known that a wire can be made to carry as much as 50 Morse operators can put into it.

There have been reasons, commercial, mechanical and prejudicial for machine telegraphy's hard road. The commercial reasons grew upon the basis of miles of wire, instead of carrying capacity being recognized as the proper basis of stock capitalization. The mechanical reasons had some foundation in the imperfections of systems, and the prejudicial reasons perhaps most powerful of all, arose from the disinclination of operators to adapt themselves to any new way of working. It has been charged and correctly, I believe, that of all nationalities, the American operator is at once the most proficient and the most prejudiced. He excels at the Morse, but will learn nothing else. He was the first to read by sound. He murmered at the duplex, kicked at the quad, and has looked with still less favor upon working a perforating machine for automatic telegraphy. Such prejudice was fully known to the Western Union Company when it was obliged to import all the perforating and other operators from England to equip the Wheatstone system. Humaston was well aware of it, and was obliged to educate young men who had no previous knowledge of telegraphy.

The exceptions to this prejudice are the men who have left the ranks to fill better positions in the service. These perforating machines have been improved from time to time by various inventors, but none of them have appealed to the fancy of the key-operator, and companies have been reluctant to introduce a separate set of operators for machine telegraphy alone.

The three-keyed puncher of the Wheatstone system contains two keys more than the Morse operator cares to use. One has always been quite enough for him, hence the necessity for imported labor. It may prove as well that the three-keyed did not operate, or that keyboard punchers have not appealed to popular favor, for necessity, often the mother of invention, has within the past few weeks brought out a perforating machine which is operated by an ordinary Morse key, and without any more labor, care or concern on the part of the operator than is imposed by the operation of a city line circuit.

The machine is up to the speed of the fastest manipulator, and can be worked a thousand miles away or under any conditions that a relay and sounder can be operated. The perforated tape may be used for transmission at 2000 words a minute, and messages recorded in plain dots and dashes at the receiving station, or it can be run through at top Morse speed and taken by sound and typewritten. Business can be collected from outlying places already

punched at the speed of the branch operators and put on trunk lines at any speed required. In Morse transmission, the tape would average double the speed of key transmission, and this, without crowding the typewritist at the other end.

Taking into account the inroads of the telephone on the telegraph business, the small number of telegrams carried—about one per head per year—the necessity for cheaper rates and greater volume is apparent. In connection with this important improvement by Mr. Delany, which makes every operator in the country a perforator as well as a key-man, it would seem that great changes in telegraphy are close at hand, and when the letter-carrying telegraph starts, long-distance telephony will feel it sharply, for no talking machine can keep up with a 2000-word-per-minute recorder.

The editorial in the ELECTRICAL WORLD AND ENGINEER, of March 9, 1901, forecasts clearly the near future of the changed conditions in the telephone and telegraph situations, and I venture to quote it closely as follows:

"Where will this great jump in telephony leave the telegraph? That is by no means a small problem. With a telephone in every house the use of the telegraph, except for long-distance work and for press matter, would appear to be sadly limited, and this fact may account for the presistent weakness of Western Union all through these years of prosperity. It has been rumored that some of the independent telephone companies are proposing to develop machine telegraphy on their lines when dull at night. The contrary proposal would be for the telegraph companies to do telephoning by day and also to turn their district messenger system into local telephone exchanges. There are elements of both strength and weakness in such a plan. At any rate, it is difficult to believe that hereafter the two branches of work can be kept as distinct as they have hitherto been, and the entire electrical community will watch with deep interest to see just what the actual developments may be."

The Edison Storage Battery.

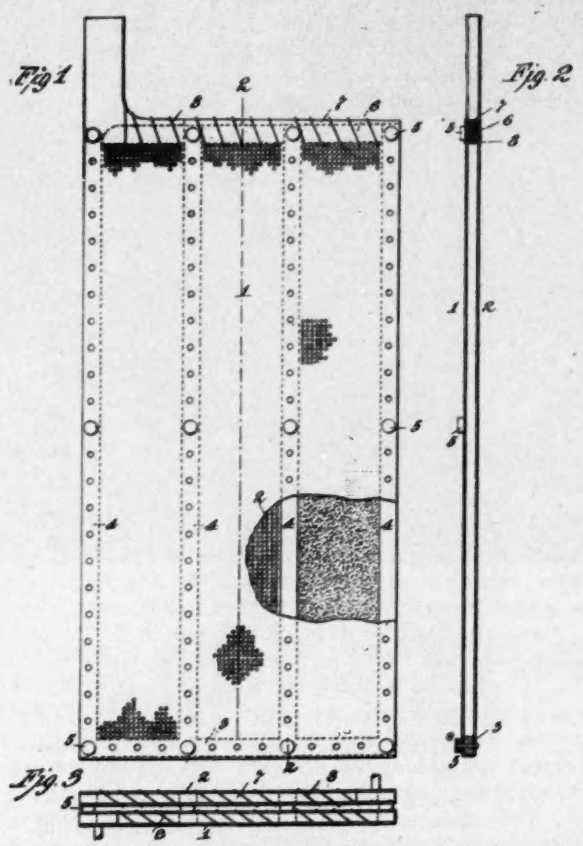
In our issue of July 6 appeared the specifications of an English patent relating to the new Edison storage battery, and we print below in full the specification of the corresponding United States patent, which was issued July 16. While the two specifications are identical in greater part, the American patent is somewhat more full in detail, and has an added interest from the references given to the subject matter of other applications now in the Patent Office relating to the same type of battery.

The patent contains 26 claims, in all of which the term "reversible galvanic battery" is applied to the invention. One of the more general claims is as follows: "In a reversible galvanic battery an alkaline electrolyte, a conducting support carrying finely divided iron when charged, another conducting support comprising a receptacle having elastic walls, and an oxide of a specific magnetic metal other than iron carried within said receptacle and engaged by the walls thereof with an electric pressure, said oxide being capable of furnishing oxygen for the oxidation of the iron on discharge." In other claims the words *ferrous oxide*, or *finely divided oxide of iron* are substituted for *finely divided iron*, and in some claims with the addition of the words *flake graphite intimately mixed* therewith. Similarly, the words *oxide of nickel* are substituted for *specific magnetic metal*, in some claims also with the addition of the flake graphite clause.

In my application for letters patent, filed Oct. 31, 1900, Serial No. 34,994, I describe an improved reversible galvanic cell wherein the metals, cadmium and copper are employed as the elements in an alkaline electrolyte, and by means of which I secured a very permanent cell, one wherein the initial and final states of the electrolyte are the same, and, finally, one which was capable of storing a greater amount of energy per pound of cell than batteries commercially used before that time for the same degree of durability. My present invention is designed to further lighten the weight of the cell in comparison to the stored energy and to deliver the energy to the exterior circuit at a higher rate.

In the alkaline zincate type of battery as commercially used, so far as I know, copper oxide has heretofore been used exclusively as the oxygen-furnishing element when the battery is discharged, the copper being reduced to the metallic state. The only other elements which have been suggested and would be available as substitutes for copper in these batteries have been those lower in the electrolytic series, such as mercury and silver; but so far as I know these metals have not been satisfactorily or commercially utilized on account of the difficulties arising from their application in alkaline electrolytes, as well as because of their expense, especially in regard to silver, which metal possesses the further disadvantage of being quite soluble in the electrolyte when subjected to oxidation. I have sought by a great many experiments for an element or compound capable of being used in an alkaline electrolyte, the heat of formation of whose oxid should be as low or lower than that of oxid of mercury, and in this I have been successful, the result being the discovery of an element for furnishing the oxygen to the oxidizable element on discharge with even greater freedom than oxid of mercury, while at the same time the new element is less expensive, is of less weight, is of greater permanency, and finally is of greater insolubility in the electrolyte. I have also sought by experiment for an element superior to cadmium as the oxidizable element on discharge, with the object in view of further reducing the weight and cost of the cell, and I have discovered an element for the purpose possessing these desirable characteristics. As a result a reversible galvanic cell equipped with the new elements is of great permanence, is relatively light and inexpensive, and is of great power.

The elements are preferably carried or supported by hollow perforated plates, forming receptacles or pockets, which are illustrated



FIGS. 1, 2 AND 3.—DETAILS OF EDISON STORAGE BATTERY.

in the accompanying drawings, forming part of this specification, and in which—

Fig. 1 is a face view of one of the plates, having three pockets or receptacles, showing the front wall partly broken away. Fig. 2 is a section on the line 2 2 of Fig. 1. Fig. 3 is a plan showing two of the plates forming a single combination, and Fig. 4 an enlarged detail section.

In all of the above views corresponding parts are represented by the same numerals of reference.

Each plate is formed with two walls 1 and 2, constructed, preferably, of a single continuous sheet, made, preferably, of very thin sheet-nickel—say, about .005 of an inch in thickness—and bent at its bottom around a horizontal frame 3, from which extend the vertical spacing-frames 4 4, to all of which frames the sheet is secured by means of nickel rivets, as shown, to form a strong rigid hollow plate, with pockets or receptacles between the vertical frames 4 4. The walls 1 and 2 of the plate, as shown, are perforated with small holes arranged very closely together, and each about .015 of an inch in diameter. I prefer to use nickel in the construction of the plates, since that metal is not oxidizable by electric oxidation in an alkaline solution. Iron, on the other hand, is slightly oxidized under these condi-

tions and is not so desirable; but if very carefully and perfectly plated with nickel it may be used satisfactorily for the construction of either the plates or the frames. Obviously the frames 3 and 4 may be, and in some instances preferably are, constructed of hard rubber or other inert material, to which the perforated sheet is riveted, as explained. Secured to one or both of the sides of the plate are a number of insulated spacing blocks 5 5 to prevent adjacent plates from touching when immersed in the electrolyte.

In the manufacture of my new oxidizable element for use in a reversible galvanic cell I first preferably take monosulfid of iron and reduce it by a crushing operation until the particles thereof may be passed through a screen having about 40,000 openings per square inch, and I intimately mix about eight parts, by weight, of the powdered monosulfid with about two parts, by weight, of flake graphite of a size considerably larger than the perforations in the walls of the pockets or receptacles. Flake graphite being exceedingly thin and of large area gives an extensive conducting-surface in proportion to its bulk and weight. This mixture is then moistened with a 20 per cent solution of potassic hydroxid, and the dampened mass is packed into the pockets or receptacles of the proper plates by a suitable tamping-tool. Owing to the want of flexibility of the graphite, the mixture packs to a hard porous mass. The effect of electrolytic gasing therefore does not disintegrate the mass as a whole when properly compressed. After each pocket or receptacle has been tightly packed with the mass almost to its top a wad of asbestos fiber 6, about a quarter of an inch in thickness, is introduced into the pocket or receptacle above the mass, and on top of this packing is placed a strip of sheet-nickel 7, entirely covering the asbestos and filling the mouth of the pocket, which strip is permanently secured in position by nickel wires 8, threaded through the openings near the top of the pocket, as shown particularly in Fig. 2. The element thus formed is subjected to electrolytic oxidization in a solution of potassic hydroxid, whereby sulphur will be set free and combining with the alkali forms a sulfid of potassium, which diffuses out of the mass, while the iron is converted to a ferrous oxid thereof. This diffusion of the alkaline sulfid out of the plate is hastened and facilitated by subjecting the contents of the plate to alternate oxidization and reduction by alternately reversing the oxidizing current, and by several of these operations the whole of the sulphur will be eliminated and the element will be ready for use after the iron has been reduced to the metallic state. Since iron does not decompose water, there will obviously be no local action between it and the graphite. The oxid formed from the sulfid increases in bulk and being intermediately mixed with the graphite produces considerable pressure on the walls of the plate, which prevents any disturbance of the initial state of the mass even when it is subjected to strong gasing within the pores by overcharging the element electrically. The object of using the monosulfid is to secure the greatest amount of iron oxid in the smallest space and in a form capable of being reduced to the metallic state electrolytically.

My attempts to utilize iron as the oxidizable element in an alkaline reversible battery were for a long time frustrated by the facts, determined only after exhaustive experiments, that dried oxids or iron were not reducible to any extent by the current; that spongy iron reduced by hydrogen from different iron salts was not oxidizable to any considerable extent by the current; that the hydrates of iron were very bulky and difficult of use without drying, which operation effected some obscure change therein to render them nearly inert in the presence of the reducing current; that bulky ferric oxid was not capable of any considerable reduction by the current, and, finally, that ferrous oxid, though easily reducible, was very difficult to prepare on account of atmospheric oxidation. The formation of the ferrous oxid, in the first instance, within the pockets or receptacles did away with the objections due to the bulk of the hydrates, while the oxid thus formed in perfectly reducible by the current. Instead of forming the oxid in this way by oxidizing the monosulfid in an alkaline solution, it will be obvious that salts or iron, like ferrous chlorid, may be packed with the graphite and when placed in an alkaline solution form chlorid of the alkali and ferrous oxid of iron, the alkaline chlorid diffusing out of the mass. The results, however, are not so good as when the sulfid of iron is used, since the quantity of finely divided iron produced thereby is considerably less and is also less porous, offering, therefore, a reduced opportunity for the solution to penetrate the mass and lowering in consequence its current-conducting capacity. Metallic iron, even when finely divided, as produced by electrolytic reduction, does not of itself oxidize in solutions of the fixed alkalies, and the oxid of iron is not appreciably soluble. Compact, dense or non-porous iron, i. e., iron having relatively large particles, when subjected to a powerful electrolytic oxidation forms a small quantity of a soluble ferrate of the alkali and dissolves in the electrolyte. On the other hand, finely divided iron obtained as described when subjected to electrolytic oxidation does not form a soluble ferrous oxid. My improved oxidizable element is therefore absolutely permanent, so that in the operation of the battery the electrolyte is not changed at any stage of the working, and absolutely no deterioration of the iron element takes place.

Having described the advantages and characteristics of and the preferred manner of making the oxidizable element, reference will now be made to the preferred oxygen furnishing or storing element of the cell.

I have discovered by experiment that the lower oxids of nickel and cobalt when in contact with a conductor in an alkaline solution can be almost wholly raised from this lower to a higher stage of oxidation electrolytically than is possible by chemical means and that these higher oxids revert to a lower stage by reduction with extreme ease, and availing myself of this fact I have constructed an oxygen-storing element capable of great capacity, of light weight, and of high permanence. Neither the oxid of nickel nor of cobalt is appreciably soluble in an alkaline electrolyte, and both nickel and cobalt give nearly the same voltage in use; but since nickel is less expensive than cobalt I prefer to use the former element for the purpose.

The preferred process of making the oxygen-storing element consists in first precipitating either the monoxid or black hydrated dioxid of the metal—say nickel—in the usual way, washing the precipitate free from the products of the reaction, filtering off the liquid, and drying off the precipitate. The resulting dried hydrated oxid is then powdered very fine and is ready for use. Either oxid may be used with the same results. The process above outlined applies to cobalt as well as to nickel. About seven parts, by weight, of the finely powdered hydrate and three parts, by weight, of flake graphite are then intimately mixed and moistened with a small quantity of a strong solution of potassic hydroxid, so as to dampen the mass, which is then inserted in the pockets or receptacles of the proper plates in small quantities at a time and thoroughly tamped at each accession. Finally the mass is covered with a layer of asbestos, held in place by a plate of nickel secured in position by nickel wires, as I have described in explaining the make-up of the oxidizable element. The plates, the pockets of which are thus supplied with the mixture of the hydrated oxid and graphite, are then immersed in a solution of potassic hydroxid in water and subjected for a considerable time to an oxidizing current of about 50 milliamperes per square inch of surface, during which the oxid is either raised to a higher stage of oxidation than the black oxid (Ni_2O_3) or else acts as an absorber of oxygen is some manner unknown to me. Whatever the action may be, the oxid so treated acts as a most efficient oxygen-storing element for commercial use in a galvanic battery.

The object of employing graphite, which is not affected by electrolytic oxidation, is to offer a great extent of surface against which the whole of the oxid is in contact, a large conducting surface being necessary, since the electrolytic reduction and oxidation for practical purposes only extend a small distance from the conducting surface against which the oxid is in contact. This is admirably effected by the use of graphite in its micaceous form, the proportions indicated being such as to practically insure that the electrolytic action need not penetrate a greater distance from the contact surface than the thickness of a single particle of the powdered oxid. Furthermore, there is no local action between the nickel or cobalt oxids and the graphite.

The reason why nickel hydrate is preferably used instead of other compounds of nickel is that the metal itself when finally divided (as obtained by reducing a nickel compound by hydrogen or electrolysis) is not oxidizable to any considerable extent when subjected to electrolytic oxidation in an alkaline solution. The sulfid of nickel is not decomposed by electrolysis under the conditions of battery work, and the sulfid of cobalt only imperfectly. Hence the hydrates are the most available compounds for use, since they do not become inert to the same extent as hydrates of the oxids of iron after drying, they are easily prepared, and by absorbing the solution they swell within the pockets or receptacles, so as to insure intimate contact and stability. During the charging of the cell the absorption of oxygen by the oxid of nickel or cobalt causes the oxid to further swell and bulge the pockets or receptacles outwardly, and on discharge a proportionate contraction takes place. In order that the walls of the pockets or receptacles may always maintain the desirable intimate contact with the active material, the pockets are, as stated, made of some highly-elastic metal, such as hard-rolled sheet nickel, so that at each con-

traction of the mass the pocket-walls will by their elasticity keep in contact therewith.

Having constructed the two elements of the battery as above explained, they are preferably utilized together in a solution of 25 per cent of potassic hydroxid in water and the cell is ready for use, and when charged the iron is in the metallic form and the nickel or cobalt oxid is raised to the superperoxid stage described.

Owing to several obscure reactions which take place when the battery is discharged, and also to a change of resistance within the electrodes, the voltage is variable; but the average voltage over the whole discharge is about one volt, rising as high as 1.32 volts, and sometimes higher, when freshly charged.

My improved battery can be overcharged, fully discharged, or even reversed and charged in the opposite direction without any injury. Overgassing does not disturb the initial state of the materials in the pockets, all the ingredients are insoluble, the supporting plates are unattacked by electrolytic oxidation, and the whole operation is independent of the strength of the solution, so that the battery is of great permanence, while at the same time more energy will be stored per unit of weight than with any permanent practical combination heretofore suggested.

I have constructed a battery as above described which gives an available storage capacity of one horse-power-hour for 73 lbs. weight; but it may be made lighter without destroying its permanent character.

The specific magnetic metals are iron, nickel and cobalt. By the expression "oxid of a specific magnetic metal other than iron" as employed in my claims I mean oxid of nickel, oxid of cobalt, or a combination of such oxids. By the use of that expression it is my purpose to embrace and include generically both of these utilized oxids.

I do not claim herein the new depolarizer *per se* comprising an electrolytically-active oxid of nickel or cobalt, nor do I claim herein broadly such depolarizer when used in a battery of the improved type invented by me, wherein the electrolyte remains unchanged at all tims and wherein both the active materials are insoluble in all conditions of use, nor do I claim herein such a depolarizer, broadly, in combination with any suitable oxidizable materials. In my present application I claim the new oxidizable element *per se* and in combination with the new depolarizer. Claims, first, on the new depolarizer *per se;* secondly, on such depolarizer when used in a battery of the new type invented by me, and, finally, on such depolarizer in combination with any suitable oxidizable element are made in my application for letters patent filed on even date herewith (Case No. 1061) as a division of my application filed March 1, 1901, Serial No. 49,453, of which the present case is also a division. Claims on an electrolytically active oxid of cobalt used as a depolarizer are made in my application filed March 1, 1901, Serial No. 49,452.

The Alkaline Nickel-oxide Cell.

BY PROFESSOR ALBERT L. MARSH.

ALTHOUGH the books on storage batteries do not mention any cell which uses an oxide of nickel in an alkaline solution as a depolarizer, it seems that the idea is not new. Michalowski, in particular, has worked in this field, and now Edison has taken up the task and promises a practical storage battery.

Some months before Edison's nickel-iron cell was announced and without knowledge of the work of Michalowski, the writer undertook to use an oxide of nickel for the positive plate in an alkaline cell. The idea of its use in this way was suggested by a fact first observed by Fischer, that a brownish black deposit separates at the positive pole when an alkaline solution of nickel tartrate is electrolyzed. The formula, $Ni_2O_3.2H_2O$, was assigned to the product as the result of chemical analysis. The oxide obtained in this way is a strongly negative substance, producing in alkaline solution an e. m. f. of about 1.65 volts with zinc and 1.35 volts with cadmium. The e. m. f. produced varies slightly with the strength of current used in depositing the oxide coating.

Before proceeding further it would be well to consider briefly the different oxides of nickel so that a clear idea may be had of the relations of each, together with the names commonly used. There are three well-defined oxides of nickel known.

1. Nickelous oxide or protoxide of nickel (formula NiO) is a green powder, turning yellow upon heating. It oxidizes to Ni_2O_3 upon being heated above 350 degs. C., and is converted to NiO again upon raising the temperature above 600 degs. C.

2. Nickelic oxide or nickel sesquioxide (formula Ni_2O_3), sometimes but wrongly called peroxide of nickel, is a black powder formed by decomposing some salt of nickel, as nickel nitrate $Ni(NO_3)_2$, or nickel chlorate $Ni(ClO_3)_2$, by heating to the lowest possible temperature which produces the decomposition. It is also formed by the action of hypochlorites upon nickelous oxide suspended in alkaline solution.

3. Nickelo-nickelic oxide (formula Ni_3O_4) is a gray metal-like non-magnetic solid.

A sub-oxide of nickel (formula Ni_2O) is said to exist.

The peroxide, supposed by Edison to have the formula NiO_2, and called by him superoxide of nickel, is formed by the action of electrolytic oxygen on nickelic oxide in an alkaline solution. It is thought to be formed by the action of hypochlorites on the hydrate of nickelic oxide, $Ni_2O_3.3H_2O$. Wicke gives the composition as Ni_4O_7, and Bayley as Ni_2O_5. When formed in the wet way a hydrate of the oxide results rather than the simple oxide, but in most cases it is necessary to consider only the simple oxide.

The nickelic oxide, Ni_2O_3, prepared in any way except electrolytically, is inert; that is, it produces no e. m. f. when opposed to zinc or cadmium in an alkaline solution. When, however, an electric current is sent through the solution from the nickelic oxide plate to the cadmium, the couple becomes active. It is quite probable that the substance of the active nickelic oxide plate is a higher oxidation product.

The nickelic oxide prepared electrolytically as described above is at the same time subjected to an oxidizing influence, so that very likely it, too, is a higher oxidation product. The fact that analyses of the latter gave Wernicke results pointing to the formula $Ni_2O_3.2H_2O$, is not remarkable, since the peroxide is very readily reduced, the reduction being especially easy in the medium in which it is formed. The tartrate acts as a reducing agent. I find that the oxide layer, which is quite black while the current is passing, immediately grows lighter in color when the circuit is broken, and the reduction proceeds to the formation of some green oxide, NiO; but if thoroughly washed while the current is passing, no considerable reduction takes place and the product may stand in a solution of pure potassium hydroxide (or sodium hydroxide) an indefinite length of time without apparent change.

The equation representing the discharge of the new Edison battery is assumed by E. F. Roeber to be

$$Ni\ O_2 + Fe = Ni\ O + Fe\ O$$

It is more probable that theoretical NiO_2 is reduced to Ni_2O_3 rather than to NiO. Even at this, the theoretical weight efficiency of a nickel peroxide plate is about 1.75 times that of a lead peroxide plate with its required amount of sulphuric acid. If, however, the peroxide has the formula Ni_4O_7, the theoretical weight efficiency would be less than that of a lead peroxide plate.

The decrease in weight of the new Edison cell is chiefly due to the use of iron for the negative plate (theoretical weight efficiency about five times that of a lead plate with its necessary H_2SO_4) and to the smaller amount of liquid required.

A fully charged cell having zinc for the negative plate may show an initial voltage of 1.9 per cell, and substituting finely divided cadmium for the zinc I have obtained a little more than 1.6 volts per cell at the beginning of discharge. The e. m. f. in the case of the cadmium cell drops gradually to zero, and in order to get a good return in ampere hours a considerable part of the current must be taken at less than 1 volt per cell.

Novel Chimney Sweeping.

The Philadelphia *Record* notes the following instance of a well-known electrical phenomenon: Employes of the Vineland, N. J., flint glass plant are marveling at a weird phenomenon. The furnace was out of blast and the workmen had been set to work to clean the soot from the high smokestack. They were sitting about complaining of the job on account of the hot weather, when a storm broke upon them, an electric bolt entered the furnace door, went down into the bowels of the furnace and then up the high stack and out. When the men entered the furnace to see how much damage had been done they discovered, much to their amazement and delight, that the lightning, which did no damage whatever, had completely cleaned the inside of the stack and left the soot in a pile at the bottom.

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Depreciation of Lighting and Telephone Plants.

AT a meeting of professional accountants, recently held at the Chicago Beach Hotel, George Wilkinson, vice-president of the Illinois Association of Public Accountants, read a most interesting paper, entitled "Depreciation of Plant." Mr. Wilkinson invited his fellow accountants to agree that "It is a fundamental law that you cannot make profit out of the turn of wheels, without incurring wear and tear, and hence a charge against the earnings for depreciation." He then proceeded to show how the wear and tear arises and in what manner it should be dealt with in certain distinct kinds of business. Particularly interesting and instructive is that part of Mr. Wilkinson's well-thought-out paper, that deals with the rate at which depreciation should be charged against the earnings of an electric light works and of a telephone company. For the benefit of such of our readers as are interested in the accounts of these two most important public utilities, we quote the following:

For the purpose of an illustration, let us take an electric light and power plant, worth, say, $100,000, and follow it along a supposititious history of four years, writing off 10 per cent of the cost of the plant each year for depreciation. The cost of maintaining such a plant, repairing breaks and keeping it in a high state of efficiency, will run from $5,000 to $10,000 a year, and must be charged direct against the earnings, as a matter of course. This must not be considered in connection with the matter of depreciation.

The first year's charge for depreciation will be $10,000, leaving $90,000 in plant account. During the second year a new dynamo is purchased and its cost (say, $3,000) is added to plant account. The second year's charge for depreciation will be $9,300, leaving $83,700 in plant account. During the third year the plant must be enlarged, two new dynamos and a new engine are put in, while two old dynamos, found to be too small, are taken out and replaced by larger. The total cost of these improvements comes to $10,000, which makes the charge for the third year's depreciation $9,370, leaving $83,330 in plant account. During the fourth year it is found that two of the old boilers have given out and are not worth the room they occupy in the boiler house. New boilers are installed, which cost, with their brick settings, $15,000. This is all charged to plant account, and makes the charge for the fourth year's depreciation $9,833.

Now, we can see where the method under discussion has led us. The charge for replacing the plant has been almost evenly distributed. The first four years' earnings have been charged from $9,300 to $9,800. If no such method has been used, the first year's earnings would have borne no portion of the replacement, while the fourth year would have had to face a charge of $15,000. If, now, we are prepared to admit that the replacement of a plant should be provided for out of the earnings by an annual charge, we will proceed to ask at what rate should this charge be made and on what sum should it be computed. The machinery of an electric light works is divisible into three classes: 1. Steam-generating plant, including boilers, furnaces, heaters, pumps and steam piping, whose steady habits contribute to longevity and which are convertible to use in another line of manufacturing business. 2. Light-generating machinery, including engines, dynamos, generators, converters, etc., all of which being driven at a terrific speed, are subjected to a tremendous wear and tear, and are prone to become obsolete, and cannot be used for anything else. 3. Distributing plant, including underground conduits, poles, cross-arms, cable, wire, lightning arresters, meters, and similar apparatus, all of which are out of doors, subject to decay caused by wind and weather, and liable to the caprice of city councils. A different rate of depreciation could be computed for each division of the property, but when all is done I believe that the sum which should be charged would figure out 10 per cent per annum on the cost of the plant.

As to Telephone Plants.—The charge to be made against the earnings of a telephone company, with respect to depreciation upon its plant, should, in my opinion, be at the rate of 10 per cent per annum, on the average amount of plant in use throughout the year, based on the actual cost of construction. This charge for depreciation is separate and distinct from the charge for current repairs and maintenance, and is made to provide against the inevitable decay of the plant and the superannuation of the equipment. Telephone companies, in all large cities, have, during the last two or three years, put in, or are now putting in, entirely new modern and highly improved switchboards, manufactured especially for their requirements at enormous cost. These are provided with one common battery, situated at the central office, which displaces the old individual batteries in the subscribers' offices or residences, with which we used to be so familiar and which were constantly in need of inspection at the hands of an unwelcome lineman. The removal of the receiver from its hook by the subscriber calls the attention of the switchboard operator, by illuminating a small electric lamp on the switchboard, in connection with the particular subscriber's plug socket. This device has earned the name of the "Visual signal switchboard." This highly improved switchboard is the latest thing of its kind that is known to the art of telephony to-day, but who is prepared to say that it will so remain ten years?

Nor is the advance of modern science, as applied to the company's own business, the only factor that affects the question of depreciation. Ten or fifteen years ago, when telephones were comparatively little used, a single iron wire grounded line rendered efficient service in large cities, but the advent of trolley cars, the multiplication of overhead electric circuits, and the ravages of electrolysis have compelled the telephone companies to substitute metallic circuits of insulated double copper wires throughout their systems, in order to secure the greater conductivity necessitated by the interference of other modern business. From the minute you set up a creosoted pine pole in the ground, load it with cross-arms and glass insulators and string thereupon copper wires, a process of decay in all parts sets in, which is as sure as death. From the minute you build brick manholes and lay wooden conduits in the ground and pull through them leaden pipe, filled with insulated telephone wire cable, a process of disintegration sets in, which will, all too soon, eat up the entire construction. The rapid advance in the science of telephony is constantly throwing out apparatus—switchboards, batteries, transmitters, receivers, lightning arresters and all the rest, that have become antiquated.

In the examination of the books and records of a large telephone company, doing business in several of the Southern States last summer, there were brought to light certain facts, which seemed to me to eliminate a great deal of controversy on this much discussed question of depreciation, as applied to telephone plants, and to afford a specific basis for calculation. First, as to the decay of the plant. The great Southern Company built a telephone plant in New Orleans from 1883 to 1885. In 1899 this telephone plant was scrap. With the exception of a couple of hundred old 60-ft. cedar poles, which, from their great stature, claimed much regard from the rebuilding contractors, not a stick nor a string of the original plant remains in service to-day. This demonstrates that the life of that part of a telephone plant that is out of doors (in New Orleans) is from 12 to 15 years. By reason of the great humidity of the air in the Crescent City, the level of whose streets is some 7 ft. below the Mississippi River, and whose soil is super-saturated with filthy water, rising within a foot of the cobblestones, the decay and consequent depreciation of such a plant is unquestionably more than it would be in a dry city like Chicago. But allowing for this, I should estimate the life of outdoor plant, of telephone and telegraph companies, at from 15 to 17 years.

Then, as to the superannuation of the equipment, the main item of equipment in a telephone exchange is the switchboard. All the minor parts and implements are shorter lived. The average life of a switchboard in a large city was determined in the case of the examination previously referred to. The switchboard in Memphis was installed in 1888, and was taken out and thrown away in 1900. The switchboard in Nashville was installed in 1885, and came to an end in 1900, while the New Orleans board, installed in 1884, was taken out in 1898.

In each case the switchboard was taken out because its usefulness was at an end. Without being absolutely worn out from actual use, it had to give way to a more modern apparatus installed at enormous cost. In each case the old switchboard and all its wiring and accoutrements were so much junk, fit only for the scrap heap. These facts seem to fix the life of a switchboard, and all its contributary equipment, at from 12 to 14 years.

In the absence of an annual charge against the earnings for depreciation, a telephone company would be unprepared to meet the large expense of replacing a switchboard, costing $46,000 for 3300 circuits, out of the earnings for the year such replacement was made, but, on the other hand, a company that has made a regular annual charge against the earnings of 10 per cent on the cost of the plant, will, in 15 years, have provided a fund out of which the entire plant, by that time ready for the scrap heap, can be rebuilt.

Western Practice in Long Distance Transmission—III.

(*Concluded.*)

TRANSFORMING APPARATUS.

In comparing the experience of various companies as to burnouts of high-tension static transformers one is struck with the uniformly good record of certain particular types, sizes and makes, and the very bad record of some others. All of which goes to show that the matter of insulating high-tension transformers is a matter of no inherent difficulty, and is mainly a matter of proper design and care in manufacture. Both oil and air-cooled transformers have made good records, most of the burnouts being attributable to faults in design of certain sizes and types of oil-cooled transformers, other sizes of same make showing good records. The oil-cooled transformer does not radiate its heat as fast as that cooled with the air-blast, and, consequently, must be larger for the same output. To counterbalance this is the cost of running the blast fan.

The question of rotary converter *vs.* motor generator is one that has come up in nearly every power-transmission plant in the West. Most of these plants are operated at 60 cycles, except those near Los Angeles, which are 50 cycles. Were these plants for power purposes only and of lower frequency the rotary converter would probably have matters its own way as it is only under extreme conditions that rotary converters behave badly on 25 or 30-cycle circuits. One bad case of surging or pumping of a rotary on a 30-cycle circuit has come under the writer's notice, however. The rotary in question had laminated fields, and was on the end of a long transmission line, which was also supplying a load consisting mainly of induction motors. It would pump so badly it could not be operated in parallel with other rotaries and generators, although equipped with copper bridges between poles. Another rotary of similar size and same make with solid cast fields ran well on the same circuit.

A rotary converter to run on 60-cycle current must either have a large number of poles with brushes close together or run at a high speed. If built with a large number of poles the brushes are too near together for convenience in handling, and there is danger from flashing from one brush to the other over the surface of the commutator. If run at a high speed, which is the horn of the dilemma usually taken, the commutator and brush wear is considerable, and the noise is unpleasant. Added to this is the inclination of the 60-cycle rotary to pump. For these reasons many engineers steer clear of 60-cycle rotary converters, and, at least, one manufacturing company puts them in under protest, recommending motor generators instead. In spite of these objections it must be admitted that there are a great many 60-cycle rotary converters in successful operation in the West, though that operation is not in all cases as entirely satisfactory as one could wish. The matter of commutator and brush wear should rightly be figured in the cost of operation when the two types of converting apparatus are considered. While it may be a nuisance to the attendant it should be figured on a dollars and cents basis. The question of surging or pumping is more serious, as it may render the plant inoperative. One engineer of considerable experience who is operating 60-cycle rotaries under as trying conditions as to load variations as are to be found anywhere in the West, gave as his opinion that the pumping of rotaries was largely a matter of regulation, induction and line drop, and that with good speed, regulation at the power house, small line drop and a good power factor, there is no trouble from rotary converters pumping. Taken altogether, the status of the 60-cycle rotary seems to be that it usually gives good results, but there is just enough uncertainty about it to cause a little uneasiness. Motor generators are much more expensive and less efficient, but if driven with an induction motor do not begin to require the skill in attendance that a rotary converters does, because they do not require to be in synchronism when operating. A motor generator with a synchronous motor is nearly as exacting as a rotary converter as to attendance in times of trouble on the line. It practically never pumps when loaded. The advantage of being able to control the field strength and voltage of the direct-current generator on a motor generator set independently of the supply circuit is sufficient to turn the balance in its favor sometimes, in spite of its cost and lower efficiency.

POWER FACTORS, INDUCTION AND CAPACITY.

The effect of a large number of induction motors lightly loaded being to cause a large wattless current and reduce the power factor on the transmission line and consequently to reduce its useful capacity most companies operating short lines endeavor to place a few synchronous motors among large consumers of power. If these motors are large for the work they have to do they may be a considerable help in improving the power factor on the transmission line if the control of their field strength is under the supervision of the transmission company. On long lines the capacity of the lines is sufficient to counteract considerable self-induction. On the 120-mile aluminum line of the Standard Electric Company, of California, dangerous rise of potential at the ends of the line due to capacity when the line is open at sub-stations will be provided against by induction coils to be removed as the load comes on. With plants as well loaded as most are there is little trouble either from induction or capacity.

WATERWHEEL EFFICIENCY AND GOVERNMENT.

Waterwheel government, which was for several years considered a bugbear, is now in such a state of perfection as to rival steam engine government. The old idea that a column of water several hundred feet high and weighing tons must be stopped and started by the opening and closing of a throttle to govern the wheels for an extremely variable load has given place to more rational methods, which deflect the nozzles or deflect the stream for sudden fluctuations if the head is a high one.

Plenty of flywheel effect is one secret of good waterwheel governing, as this gives the governor time to act. In this respect revolving field generators with their great mass of revolving metal are an advantage, to say nothing of their numerous advantages in other respects.

More attention is being paid to waterwheel efficiency now that it is being realized that on the efficiency of the wheels depends the output that can be obtained from a water-power plant at low water. Especially is this true when water is stored. Waterwheels and generators are run nearer their full load than formerly in order to get the greatest efficiency and most work from a given amount of water. All methods of governing impulse wheels with one possible exception necessarily lower the efficiency very much. If the stream is deflected it is, of course, wasted, and if the supply to the nozzle is throttled the velocity and continuity of the stream is broken up and the efficiency suffers. Where generators are to be operated on partial load continuously it is advisable to have several nozzles and wheels so that part can be shut off, leaving the other nozzles going full velocity and efficiency. One form of nozzle used in the Snoqualmie Falls plant throttles the stream by a needle in the nozzle, which does not alter the velocity or form of the stream. For locations, where a throttling governor is practicable, or for accomplishing part of the regulation by hand to accommodate slow changes of load where a deflecting nozzle takes care of sudden fluctuations, this nozzle should give good results.

Waterwheel efficiencies are generally overrated by those not familiar with the actual facts. Under maximum load it is doubtful if any impulse wheel actually gives better than 78 per cent efficiency, while if the actual all-day efficiency is taken 60 per cent is doing well. It is seldom that accurate, careful tests are made on this point, but the tests that have been made by various transmission companies show that the foregoing figures are not any too low.

COMMERCIAL CONSIDERATIONS.

Almost without exception the Western transmission plants are well loaded up. There is a market for all the power they can produce, and more. This is, of course, because most of the transmissions are in the neighborhood of some good market for power and by making prices low enough it is only a question of a few months before they are carrying as much of a load as they are able to handle at low water, and in a number of cases steam plants have been put in as auxiliaries to carry the peak of the load at times of low water, and to enable a greater all-day load to be carried on the water-power plant. Such a plan has much to commend it, aside from the mere matter of expediency. A transmission plant represents a large investment on which to pay interest. By having the transmission plant (which generates power cheap, but has high fixed charges), supply the all-day load and having a cheap steam plant at the sub-station to carry the lighting peak, the investment is much less than if the transmission plant were built large enough to carry all the load and the operating expenses are but little higher.

Nearly every transmission plant in the West operating from a small stream at high head has at some time in its career experienced lower water than the installers of the plant ever figured on. There is usually a lack of accurate data on the flow of streams previous to the time plants are installed. This fact should be borne in mind by those putting in water-power plants, especially on small streams.

The future of long-distance transmission work depends fully as

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much on power transmitted from steam plants as on the development of water power. The daily newspaper editor occasionally lets his imagination run riot in picturing the time when all our power will be transmitted from waterfalls, but he omits to tell us where all these waterfalls are located that will turn the wheels of industry. He forgets that the demand for power is far in advance of the capacity of all the available water powers known, not only in the United States, but in the very Western country where water power is most abundant, and the demand for power small. And what is more, the demand for power is constantly and tremendously on the increase due to the rapid advance of commercial projects and inventions requiring it.

The list of important transmission centers in and west of the Rocky Mountains corresponds very closely with a list of the important cities and mining camps.

In Colorado the great Cripple Creek gold mining camp, with its large demands for power and high-priced coal, forms the most important center. Most of the electric power at Cripple Creek is supplied from advantageously located steam-driven plants, that of the Colorado Electric Power Company being located at Cañon City, 24 miles away near coal mines, and transmitting at 20,000 volts, and that of the La Bella Mill Water & Power Company being located on a railroad in the Cripple Creek district at Goldfield and transmitting over the district at 6600 volts. (See ELECTRICAL WORLD AND ENGINEER, Jan. 19, 1901, page 115. There are a number of smaller transmission plants about the State of Colorado, among which the historic plant of the Telluride Power Transmission Company at Telluride should be mentioned, because it is there that much valuable experimental work on high-voltage transmission was carried on. In Utah the thickly populated valley east of Great Salt Lake and the mines around Mercur and Silver City led to demands for power which have caused the erection of four large water-power plants and two smaller ones, with another going in. Ogden and Salt Lake City electric light and power are supplied by the Utah Light & Power Company, with one plant in the Ogden Cañon transmitting to Salt Lake City at 16,000 volts, and two plants in the Big Cottonwood Cañon transmitting at 11,000 volts. (See ELECTRICAL WORLD AND ENGINEER, March 30, 1901, page 503, and April 13, page 593.) Near Provo is the Telluride Power Transmission Company's 40,000-volt transmission with a high-tension belt line 105 miles around. (See ELECTRICAL WORLD AND ENGINEER, Feb. 23, 1901, page 307.) There are also two other small plants in the Salt Lake region. Butte, Mont., is another good power market. The Montana Power Transmission Company sends power in 20 miles from a plant on the Big Hole River, at 16,000 volts. (See ELECTRICAL WORLD AND ENGINEER, Jan. 26, 1901, page 149.) The Missouri River Power Transmission Company, with a 9000-kw plant on the Missouri River at Cañon Ferry, will, in a few months, transmit at 50,000 volts 73 miles into Butte, and has supplied Helena with all power for some time at 11,000 volts. On Puget Sound, Seattle and Tacoma get power from the Snoqualmie Falls Power Company at 30,000 volts. This plant has 6000 kilowatts in generators, and duplicate lines to both Tacoma and Seattle. (See ELECTRICAL WORLD AND ENGINEER, March 9, 1901, page 393.) Portland, Ore., has one company, the Portland General Electric Company, which does all of the electric lighting and furnishes about half the electric railway power for Portland from a water plant at the Williamette Falls at Oregon City, 14 miles distant, at a transmission voltage of 6600. San Francisco and Oakland were for a number of years considered too far from the mountains for practicable power transmission, but the advances in transmission voltage made in the West during the past few years and the success of the plants already installed, together with the high price of fuel in San Francisco and Oakland, and the unlimited market there has led to the building of the two longest transmission lines yet constructed. The Bay Counties Power Company began transmitting power 140 miles into Oakland at 40,000 volts, April 28, 1901. The intention is ultimately to operate at 60,000 volts. (See ELECTRICAL WORLD AND ENGINEER, Feb. 16, 1901, page 273, and June 8, page 963.) The main power house near Colgate has 15,000 kilowatts, and the company has also two other stations. The company has a duplicate pole line, one with copper wire and one of aluminum. A number of towns and mines along the route are supplied. Coming into Oakland from another direction via Stockton and San Jose is the 120-mile line of the Standard Electric Company, of California, which is also designed to operate at 60,000 volts. This has a single-pole line with aluminum cable line. Storage batteries are being put in sub-stations for regulation and emergencies. The power house is in the Blue Lakes region, near Sutter Creek, and has a capacity of 10,000 kilowatts. The intention is to operate this from the start at 60,000 volts. In the neighborhood of Los Angeles, which has been for several years the most important power transmission center in California, the two largest companies are the Edison Electric Company and the San Gabriel Electric Company. (See ELECTRICAL WORLD AND ENGINEER, June 22, 1901, page 1067, and June 29, page 1113.) The former transmits 83 miles into Los Angeles from a 3000-kw station in the Santa Ana Cañon. The latter transmits 1000 kilowatts 23 miles into Los Angeles from the San Gabriel Cañon, and has recently acquired a small plant in the San Antonio Cañon.

There are a number of smaller transmission plants in the vicinity, viz., the Redlands Electric Light & Power Company, the San Bernardino Electric Company, and the United Electric Gas & Power Company at Santa Monica. In addition to the plants around San Francisco and Los Angeles there are many small transmissions scattered over the State. This brief review gives an idea of the extent of transmission work in the West, and shows that it has passed the experimental stage, and is simply a question of return on investment. The extensive discovery of fuel oil in California will tend to discourage the building of longer lines than have been already projected, as the point will soon be reached where a long transmission line with extensive water-power development and its large interest charges cannot compete with steam power using fuel oil.

One common mistake to be avoided by promoters and investors in transmission lines is overrating the power that can be delivered and sold from a plant. An engineer of considerable experience in managing transmission properties and in a position to know the experiences of a number beside his own laid down a rule to the writer which he said he should follow were he a prospective investor in a water-power transmission plant. The rule went something as follows: "Take the minimum horse-power obtainable from your waterfall at the dryest season of the year as computed by competent hydraulic engineers, and divide this by two to determine the power you will be able to sell at the distributing board at the sub-station. Take the hydraulic engineer's estimates of the cost of the water-power development and the electrical engineer's estimates on the balance of the transmission and multiply them by two to get the investment required. If you can then see 6 per cent coming on your investment after paying operating expenses and depreciation the scheme is all right." This may at first seem to be a too conservative view of the matter, but further thought shows that it is simply looking matters squarely in the face as they usually exist. As to efficiency, if we figure the maximum full-load efficiency of all the apparatus and 5 per cent line loss we find from 60 to 65 per cent of the energy of the water appearing at the sub-station distribution board. The all-day commercial efficiency may easily be no more than 50 per cent. In the plant operated by the gentleman just quoted, 55 per cent of the theoretical energy of the water is sold at the sub-station switchboard after a step-down transformation.

Where there is a great deal of induction load, large wattless current and low-power factor also tend to cut down the useful output of the plant.

When it comes to the investment, the rule of multiplying the estimated cost by two may seem to reflect seriously on the estimators. The difficulty is not, however, in estimating the cost of doing certain pieces of work, but in providing for expenditures the necessity of which cannot be foreseen. It is for this reason that the engineer and investor must increase original estimates on investment required without knowing exactly for what the money is to be spent. The necessity for this is not limited by any means to transmission plants as most men of business can testify.

Electrical Register at Pan-American.

At the suggestion of Prof. G. F. Sever, superintendent of exhibits in the Electricity Building at the Pan-American Exposition, a register has been started for the use and convenience of electrical men at the Pan-American booth of the ELECTRICAL WORLD AND ENGINEER, Section B, Electricity Building. It is believed that such a register will prove of considerable value to the electrical fraternity in enabling friends to find each other and learn of each other's presence at the Pan-American, and that it will especially be of use during the coming electrical convention which will be held on Pan-American grounds. It will also have a historical value.

Convention of the United Electrical Contractors' Association of New York State.

C. L. EIDLITZ.

THE United Electrical Contractors' Association of New York State held its convention at Buffalo, July 16. A large delegation arrived in the morning on the train from New York, and was met at the depot by automobiles and taken to breakfast at the Iroquois Hotel by Harry B. Kirkland, general manager of the American Circular Loom Company.

After breakfast the delegates and members met at the Builders' Exchange and were taken on three special cars for a two-hours' trolley ride around the city, arriving at the New York State Building on the Pan-American grounds in time for lunch. At 2 p. m. the business meeting was held. In the evening a banquet was given at the Stadium restaurant at the Pan-American. The arrangements made by the local committee were very complex. Before the toasts began, the guests were called to the windows to see the grand illumination of the grounds at 8.30. Unstinted praise was heard everywhere of the beauty and grandeur of the electrical effects. H. I. Sackett acted as toastmaster, and was very happy in his introductions of the various speakers. F. P. Jones greeted the guests in the name of the Buffalo association, even to the "supply men who sell us rotten goods" and "the manufacturers who make the goods the supply men sell us," and the "underwriters who make trouble all around."

The victims of the roasting, however, did not seem to take it to heart much. President Rudolph Schmidt spoke a few well-chosen words on the benefits of a national association. C. L. Eidlitz kept the crowd laughing for several minutes, and paid a tribute in an original way to Mr. Stieringer and the Pan-American lighting. Then came a call for Mr. Stieringer. It took several minutes to get him on his feet, but he finally arose amid great applause, and in a few plain words, without egotism, related some of the facts as to the conception and carrying out of the Pan-American lighting, for which he was the consulting engineer. Great credit was also given to Mr. Henry Rustin for the way in which the plans were carried out. The manner in which electrical construction and current supply kept pace with the construction of the exposition was contrasted with Paris, where the electrical plant was not all finished when the exposition was over. The Omaha exposition, in which Mr. Stieringer first tried lighting entirely by incandescents, its success, the awards made thereon and its influence as a factor in leading up to the Pan-American lighting were touched on. At the close, Mr. Stieringer received a tremendous ovation and congratulations from all quarters. The illumination of the grounds just witnessed by the guests was fresh in mind, and this with the intimate knowledge that many had of Mr. Stieringer's part not only in this but in many previous American expositions all led up to the enthusiasm with which his remarks were received, and finally three cheers were given for "Stieringer and the illumination." After a toast by Professor G. F. Sever on the electrical exhibits on the grounds the banqueters adjourned to the Midway.

The entertainment committee which was responsible for the excellent way in which guests were entertained both at the State and national conventions was J. C. Stearns, F. P. Jones, E. D. McCarthy and H. I. Sackett.

The following members or representatives were present:

New York.—Harry Alexander, A. J. Martin, Commercial Construction Company; S. Davis, Conduit Wiring Company; Mr. Edwards, Edwards & Co.; C. L. Eidlitz; Hatzel & Buehler; J. P. Hall; Mr. McLeod, McLeod, Ward & Co.; Mr. Russell, Russell & Co.; Tucker Electric Construction Company; E. S. Kiefer, Western Electric Company; Mr. J. T. Hunt, Zimdars & Hunt.

Utica Association.—W. C. Ballda, Utica Light & Power Company; Johnson & Morton; E. S. Hamlin, Oriskany Falls.

Syracuse Association.—C. H. Thompson; David Cronin; Mr. Hilton, Rodgers & Hilton; E. S. Downes; Central Electric Company; D. J. Burns, Auburn; Binghamton Electric Construction Company, Binghamton.

Rochester Association.—E. C. Bradley, Elwood Electric Company; Frederick Fish; Higgins Almstead Company; Rochester Electric Motor Company; Rudolph Schmidt; Standard Electric Construction Company.

Eastern Association.—F. W. Newman, Albany; F. L. Frost, Albany; E. P. Lansing, Albany; W. W. Luckhurst, Capitol Electrical Works, Albany; E. P. Lansing, Albany; Mr. Barnes, Barnes & Payton; J. F. Burns, Schenectady; Seymour Taylor, Glens Falls, N. Y.

Buffalo Association.—McCarthy Bros. & Ford, Albert Mann, J. C. Stearns, H. I. Sackett, F. P. Jones; Wilhelm Telephone Manufacturing Company; Mashinter Electric Company; H. D. Pierce, Vaughn Brothers.

The local association distributed a very fine souvenir book to the guests. It was devoted to the State Association, Buffalo, and the Pan-American, and was in much demand.

Among the supply men not members present were R. B. Corey, of New York; Harry B. Kirkland, general manager American Circular Loom Company; F. J. Harrington, John A. Roebling's Sons Company; Alexander Henderson, Sprague Electric Company, New York; H. B. Coles, secretary General Incandescent Lamp Company, Cleveland; J. R. Cravath, Electrical World and Engineer.

Organization of the National Electrical Contractors' Association.

The National Electrical Contractors' Association is the name of the new organization that was formed at Buffalo, July 17. The United Electrical Contractors' Association of the State of New York held its convention the day before, which, in a measure, served as a preparation for the formation of the national body. The national meeting was called to order at 10.20 a. m., Wednesday, July 17, at the Builders' Exchange. Rudolph Schmidt, of Rochester, president of the New York State Association, was elected temporary chairman, and W. H. Morton, of Utica, temporary secretary. The chairman called on S. Davis, of New York, to give the address of welcome to the delegates from all over the country. Charles L. Eidlitz, of New York, then reviewed the history of the State Association and intimated some of the advantages that would result from the formation of a national organization. At 2 p. m. the delegates met again at the New York State Building on the Pan-American grounds, and a constitution and by-laws were adopted and credentials presented. The following officers were elected: President, Charles L. Eidlitz, New York; first vice-president, G. M. Jones, Minneapolis; second vice-president, E. T. Cooke, St. Louis; third vice-president, H. K. McKay, Baltimore; treasurer, George R. Mathieu, Pittsburg; secretary, W. H. Morton, Utica, N. Y. Directors for first year: E. D. McCarthy, Buffalo; M. L. Barnes, Troy, N. Y.; J. L. Hilton, Syracuse, N. Y.; H. A. Loeb, Philadelphia; E. McCleary, Detroit; F. E. Newberry, St. Louis; F. W. Lord, Boston; W. I. Gray, Minneapolis; J. K. Howe, Boston; C. A. Dainz, Cleveland. The time and place of the 1902 convention were left to the directors. The new association starts in with plenty of interest behind it, as was shown by the fact that there were over fifty present at the time of organization. As Mr. Eidlitz put it in the opening address, as the local organizations all over the country have proved a good thing, why should not the national organization?

The members at the close of the meeting were as follows:

New York.—S. Davis, J. C. Hatzel, J. R. Strong, A. J. Martin, J. P. Hall, E. S. Kiefer, C. L. Eidlitz, H. A. Alexander.

St. Louis.—E. D. Cooke, H. E. Lindsay, R. Rougtell, F. E. Newberry, E. Boeschenstein, A. J. Sutter, Emil Haas, S. A. Van Norton, W. A. Carrao, J. F. Burns, Edwin Keller.

Philadelphia.—T. Carpenter Smith, Howard A. Loeb.

Boston.—F. L. Barnes, F. E. Sherman.

Detroit.—Thomas E. Clark, E. McClary.

Pittsburg.—George R. Mathieu.

Baltimore.—C. M. Morfit.

Cleveland.—C. A. Dainz.

Utica, N. Y.—H. G. Hatfield, W. H. Morton, B. V. Butts, M. H. Johnson, W. C. Ballda.

Rochester, N. Y.—Rudolph Schmidt, Mr. Almstead, M. I. Horton, B. A. Vandy.

Albany, N. Y.—F. W. Newman, F. L. Frost, W. W. Luckhurst.

ELMIRA, N. Y.—C. A. Geogia.
MINNEAPOLIS.—G. M. Jones.
SYRACUSE, N. Y.—H. S. Newton.
BUFFALO, N. Y.—E. D. McCarthy, Albert Mann, J. C. Sterns, H. I. Sackett, F. P. Jones, W. L. Wilhelm.
TROY, N. Y.—M. L. Barnes.

It is expected that a large number of additional members will soon be added, as correspondence received indicates much interest from all over the country, even on the part of those not present. Those desiring further information as to the organization should address the secretary, W. H. Morton, 44 Whitesboro Street, Utica, N. Y.

Meeting of the Automobile Club of America.

The Automobile Club of America held an important meeting last week, which was attended by about 40 members, and over which Vice-President Albert C. Bostwick presided. The principal object of the meeting was the passage of several amendments to the constitution and to discuss the affiliation of the various automobile clubs throughout the country in a united effort to secure State and Federal legislation in the interest of good roads. It was decided to hold a convention, to which all the automobile clubs of America will be invited to send delegates, and at that time action will be taken regarding the legislation above outlined. One amendment was, setting the third Monday in November as the date of the annual meeting. The other amendments related to the internal management of the club. The outcome of the proposition to invite outside clubs to join in holding a convention was that a committee of seven was appointed to take such measures as might be found necessary for the calling of such a convention.

The committee was announced as consisting of President Albert R. Shattuck, Vice-President Albert C. Bostwick, the members of the law committee, George F. Chamberlain, James C. Church and David Hennen Morris, and two others, who were not named.

Exports of American Manufactures.

Exports of manufactures from the United States appear to be slightly less in the fiscal year just ended than in the preceding year, the figures for the 11 months ending with May showing an apparent reduction of $14,565,030. This statement, however, is misleading because the figures of the year 1901 do not include the exports to Porto Rico and Hawaii, which were included in former years, and which are largely manufactures, and which will aggregate $25,000,000 for the fiscal year. Were it possible for the Bureau of Statistics to include in its figures of exports of manufactures those sent to Hawaii and Porto Rico, the figures of 1901 would differ little from those of 1900.

Indeed, an analysis of the general export figures of manufactures for the 11 months now available shows in most cases an increase over 1900, and that the decrease is confined to a few articles and is due, in some cases, at least, to a fall in price rather than a reduction in quantity. In a large share of the important articles of our exports of manufactures, the figures of 1901 shows a marked growth over those of the preceding year and of any preceding year. In steel rails, for instance, the exports during 11 months of 1901 are more than $2,000,000 in excess of the same months of last year. In pig iron there is an increase of a million dollars; in bars and rods of steel, an increase of a million and a half; in electrical machinery, a million and a half; in boots and shoes, over a million dollars; in cotton seed oil, nearly two millions; in carriages and cars, two millions; in chemicals, more than a million; in scientific instruments, a million dollars, while, as already indicated, in some cases where the values have decreased, there is still an increase in quantities, the apparent reduction being due to the fall in price and not to a reduction in the quantity exported.

American manufacturers have, therefore, no occasion for anxiety regarding the slight apparent decrease in the export figures of manufactures in 1901, which is due: 1. To the fact that shipments of goods to Porto Rico and Hawaii, aggregating more than $20,000,000 in the year just ended, are no longer included in the list of exports, as was formerly the case. 2. That the reduction of over $6,000,000 in exports of cotton, cloth and mineral oils to China may be looked upon as due entirely to temporary causes. 3. That in numerous instances the reduction is due to a fall in price, while there has been an actual increase in quantity. 4. That in the principal item of decrease, copper, the figures exceed those of any preceding year except 1900, in which year the demand abroad for electrical work was far beyond that of any preceding year.

Wireless Telegraphy in Africa.

It is stated that the French Government has been encouraged by the help that the British have derived from the wireless telegraph in the Boer war, and by the results of the experiments made by the Prince of Monaco, to take steps, in a tentative way, to introduce the system into the Franco-African colonies. Arrangements have been made to carry out the experiments simultaneously both in the moist tropical regions and in the dry Sahara. The experiments in the moist, tropical regions will begin in Senegambia and Gaboon, on the west coast of Africa. They will be under the charge of M. Magne, director of the postal and telegraphic service in the French west coast colonies. He has recently left France with apparatus sufficient to equip several stations. His first endeavor will be to establish wireless communications between Rufisque and Gorée. The latter town is a mile and a half from Dakar, where large ocean vessels ride safely in deep and smooth water, and where the Atlantic cable from Europe first reaches the mainland. About 20 miles to the east is Rufisque, separated from Gorée by water. Magne's second experiment will be further south in the humid climate of Gaboon, between Libreville and Denis. These towns, about 25 miles apart, are also separated only by a water surface.

Meanwhile the project of establishing wireless communications across the desert of Sahara is under way. Two missions, equipped with modified Marconi apparatus, are to start, one from Timbuctoo and the other from Tuat, the termini of the proposed line across the desert. They are to follow the usual caravan route along a line of wells, between these two points. The two parties are to establish stations along the route, it being, of course, a necessary condition that each station is able to communicate successfully with the one established behind it. The parties will advance only as fast as this end may be attained. If they are successful they will meet in the middle of the desert and wireless telegraphy will have been establishd across the greatest waste in the world.

The Yerkes Underground Road in London.

Details have been given out with regard to Mr. C. T. Yerkes' plans to electrically equip the District Railway, of London.

Mr. Yerkes' company will be known as the Metropolitan District Electric Traction Company, Limited, and the original subscription of $5,000,000 has been completed. Contracts for equipping the road electrically, building power houses, etc., have all been approved by the District road and Parliament has passed an act authorizing the proposed action. It is understood that the directors of the new company are to be five in number, two of whom will be English representatives, two will be named by the American interests, and the fifth will be Mr. Yerkes. Mr. Walter Abbott, of Boston, who has had considerable experience in street railway and electric lighting matters through his connection with the United Electric Securities Company, has been named as the representative of the Boston interests, on the board of directors. Mr. T. Jefferson Coolidge, Jr., recently visited London and met the officers of the company and inspected the plans.

The District Railway in London is at present operated on the same system as the ordinary steam road. Fares vary all the way from 2 cents for the shortest distance, third class, to something like 40 cents for the longest distance, first class. The trains are run infrequently, the tunnels are full of smoke and the service is generally poor. It is believed with the readjustment of affairs the substitution of three and six-car trains run at regular intervals for the present eight-car trains run at irregular intervals, that the gross receipts of the road can be doubled and the cost of operation by electric power should not exceed the present cost of operation by steam.

In the case of the District Railway it may be decided to follow the lead of the Central London road and the class system may be gradually done away with.

American capital is in a large majority in the Metropolitan District Electric Traction Company. There are, however, able Englishmen in the management, and English money is expected to be more and more forthcoming. Mr. R. W. Perks, who represents Mr. Yerkes in London, is a man of marked ability and high standing. He

is a leader of the Non-Conformists in Parliament, and is considered one of the best railroad lawyers and business men in England. It is hoped that he may be induced to take the position of chairman of the board of directors of the District Underground Company. The capital stock of the London Underground road is $28,000,000, and there are about $10,000,000 debentures. The Metropolitan District Electric Traction Company, Limited, is an owner of securities of the District road, but was formed for the express purpose of electrically equipping the road.

French Electrical Engineers in America.

We have received full details of the programme of the party of French electrical engineers, which indicate that much thought has been bestowed upon the itinerary.

As stated previously in these columns, the party will arrive at New York on Sunday, Aug. 11, and leave the same evening for Philadelphia. On Monday the principal places of interest in the city will be visited, including Girard College, and the same evening a train will be taken for Washington. Leaving the latter city on Wednesday afternoon the party will return to New York, where technical visits will be made on Wednesday, Thursday, Friday and Saturday, and advantage taken of the programme of the American Institute of Electrical Engineers for those days and to the end of the Institute meeting at Niagara as follows:

Sunday, trip by boat to Albany, where the night will be spent. Monday, a visit to the works of the General Electric Company, luncheon at the same, and departure for Buffalo in the afternoon by special train. From Tuesday to Sunday attendance at the Convention of the American Institute of Electrical Engineers, visits to the Pan-American Exposition and an excursion to Niagara Falls.

On Sunday, Aug. 25, the party will start for Chicago, where it will remain until Tuesday night, leaving then for Kingston, Canada, in Pullman sleepers. Passing the night at Kingston a boat will be taken for the Thousand Islands in the St. Lawrence River. The party will then proceed to Montreal, where it will remain Friday and Saturday. On the evening of the latter day a steamer will be taken for Quebec; in that city Sunday and part of Monday will be spent, leaving Monday afternoon. From Quebec the party will go to Plattsburg by boat down the Champlain, arriving in New York on Wednesday, Sept. 4, and sailing the next day for France.

The above programme has been approved by a number of French engineers who will be in the party. Those members who desire to extend the visit to the United States for a week or fortnight may hold over for later steamers without extra charge.

CURRENT NEWS AND NOTES.

LONDON COUNTY COUNCIL is about to send an expert party to this country to study the systems of electric traction here.

THE "ADDER."—The new electric submarine torpedo boat "Adder," of Holland type, has been finished at the Nixon shipyards, Elizabethport, and was launched this week.

FARMERS' TELEPHONES.—An Indiana independent telephone company announces the approaching issue of a telephone directory of Hancock, Henry and Madison counties, Ind., which will contain the names of 2000 telephone subscribers, over 100 of whom are farmers.

WIRELESS TELEGRAPHY ON THE LUCANIA.—The Cunard line steamship Lucania, which arrived in New York last Saturday, reports that the Marconi instrument on board worked successfully, and that communication was kept up with the coast of Ireland until the vessel was 50 miles off the coast.

A LABOR INJUNCTION.—The Farrell Foundry, at Ansonia, Conn., obtained an injunction against 210 of its striking employes, prohibiting them from picketing or interference. Each employe was specifically named and an attachment was levied on the property of the men to guard against loss on the company's part if the injunction was disregarded.

WIRELESS TELEGRAPHY IN MONTREAL.—It is said that a Marconi wireless telegraph tower will be erected in Montreal for experimental purposes, in connection with the river shipping and other important interests. The position has not yet been definitely chosen, but the top of the Great Northwestern Telegraph building will probably be selected as the site.

POLES BLOWN DOWN.—The two tall telegraph poles lately erected by the Western Union Telegraph Company on the opposite banks of the Neches River, at Beaumont, Texas, were blown down by a recent storm. These poles, as noted in our last issue, were said to be the tallest in this country, if not in the world, and were erected at great cost. The wires spanned the river by suspension from these poles.

THE NEW YORK CENTRAL TUNNEL.—District Attorney Philbin has directed the New York Grand Jury to make a thorough investigation into the prevailing uncomfortable conditions in the tunnel of the New York Central Railroad, under Park Avenue, in regard to which there has of late been so much comment. It is said that the officials are maturing plans for the adoption of electricity for traction and ventilation.

WIRELESS TELEGRAPHY IN THE WEST INDIES.—A London dispatch of July 22 says: The Central News understands that the Government contemplates the introduction of wireless telegraphy in the West Indies. Trinidad and Tobago will be the first points connected. When the necessary financial arrangements are made this system of communication will be extended between Antigua and Montserrat and St. Kitts and Nevis.

TRIAL BY TELEPHONE.—A case was tried by telephone in Maine last week. Two members of a traveling company of actors had to appear at Bucksport, but could not do so if they awaited trial for disturbance of the peace on a train at Old Town, so their counsel obtained permission from the Court for them to leave by the train. Their case was then conducted over the wire, evidence was heard, fines were inflicted, and every condition of justice was satisfied.

EDISON STORAGE BATTERY NOW AT THE PAN-AMERICAN.—The new Edison storage battery arrived at the Pan-American Saturday, July 20. The exhibit consists of a single cell, and also sample plates and oxide cases, which fit into the plates. The cell weighs 5¾ lbs., and is rated to give 100 watt-hours. It is contained in a metallic case, and has eight plates. The cell occupies a place in the Edison Manufacturing Company's exhibit, and, of course, attracts much attention from electrical men.

LIGHTNING IN EUROPE appears to have been excessive and very fatal this year, and many serious disasters are reported in consequence. A special dispatch of July 21 from Paris, France, notes the following sad occurrence: A dispatch from Perpignan states that a storm burst over the village of Palan to-day and the children, in accordance with the superstition that the church bells would drive away the lightning, went into the belfry to ring the bells. The belfry was struck by a lightning bolt and four of the children were killed and five injured.

ELECTRIC POWER ON CANADIAN PACIFIC.—The Canadian Pacific Railway Company has, for some time past, been considering the practicability of utilizing the energy contained in the vast water power of the Rocky Mountains by converting this power, now running to waste through the mountain gorges, into electrical energy. The company proposes to utilize this power at various points of its system through the Rockies in hauling trains up the steepest grades, taking the place of the assistant engines, and perhaps even to be depended upon entirely, so far as the mountain districts are concerned.

ELECTRICALLY HEATED TOOLS.—A patent for which application was filed April 24, 1896, was granted July 16, to H. Ward Leonard, which relates to apparatus intended to be operated at comparatively high temperatures, such, for instance, as flatirons. As applied to this use, a flatiron is cast in one piece with a series of cylindrical holes parallel to the smoothing surface. In these holes are placed the heating conductors, which are wound on a solid cylindrical core of an insulating material such as steatite. A screw thread is cut on this core, and in the thread is wound the heating conductor. When the core is in place the conductors lie in close proximity to the cast iron.

AN EDISON INSTITUTE.—If the foreign papers are to be believed, Mr. T. A. Edison intends to endow an institute in Paris for the benefit of impecunious inventors, donating all the machinery for a laboratory, and adding a library. Mr. Edison is now away on a vacation, and hence we are unable at the moment to confirm or deny this report, with which Col. Gouraud's name is associated.

TROLLEY GROWTH.—The New York State Railroad Commissioners are receiving an unusually large number of applications for franchises for street railway companies. A tabulation which has been made shows that between 1890 and 1900, the capital stock and funded debt of trolley and other street surface roads in the State increased $304,472,083. The capital stock and funded debt of the steam surface railroads in that period increased $377,950,207.

WIRELESS TELEGRAPHY AT PUGET SOUND.—Experiments with wireless telegraphy for reporting incoming ships will soon be made between Tatoosh Island and Neah Bay, at the entrance to Puget Sound. At one time the Government maintained a station for observation on the island, but the cable to Neah Bay broke several years ago ,and since then vessels have been reported from Neah Bay. The Tatoosh Island station is now to be re-established.

MISSOURI RIVER 50,000-VOLT TRANSMISSION PLANT.—In the article which appeared in our issue of July 13 on the 50,000-volt transmission plant of the Missouri River Power Company, at Helena, Mont., one of the illustrations, reproduced from a photograph, shows two large penstocks leading to the power house. We are informed by the S. Morgan Smith Company that the penstocks have been dispensed with. A bulkhead is being built in front of the power house, and the water will be conveyed to the wheels in an open head race.

RELAY TELEPHONE.—A long-distance relay magnetic telephone is the subject of a patent granted July 16 to Jacques Nessel and Jean F. Gouin, of Brest, France. A relay is placed, say, midway in a long-distance line, its construction being such that it forms an integral part of the line. Within the casing, which is of cast metal and shaped like a double conical buoy, is a disk, on each side of which is a magnet. When the magnets have been suitably adjusted, if conversation takes place from one end of the line this disk will vibrate equally upon one side as upon the other, and these vibrations will give rise to a fresh current, which in its turn will act upon the station spoken to. In other words, the ear receiving the message in the ordinary circuits is replaced by a second telephone, communication between two distant stations thus being relayed at an intermediate point.

THE TELEPHONE IN BUFFALO.—Mr. H. W. Pope, general manager of the Bell Telephone Company, has added a feature new to the telephone business which will be probably adopted by other telephone companies, notwithstanding the expense it involves. Hereafter the numbers of subscribers' stations and the names of subscribers will be published at intervals in the daily papers as the stations are installed. That will obviate the necessary delay arising in the publication of telephone directories, which occupy generally a whole month in their compilation, publication and delivery. The directory is reaching enormous proportions and some way had to be devised to overcome the delay in the publication of the subscribers' names. About 700 stations have been installed in Buffalo since the supplement of June 1, and those names will now be published in lots of 50 until the names are brought up to date, after which they will be published in lots of about the same number, or according to the rapidity with which they are installed. Subscribers clipping those lists from the daily papers as they appear will at all times have the names complete and up to date.

A LONG TROLLEY RIDE.—It is stated that First Assistant Postmaster General William M. Johnson, accompanied by Mrs. Johnson, his brother and his wife, the Rev. and Mrs. Arthur Johnson, and Miss Kate O. White, has arrived in Boston after having traveled 268 miles by trolley cars from Hackensack, N. J. They were not seriously fatigued by the novel journey, and declared that for real rest there is nothing like a trolley trip taken as they took theirs, in almost perfect weather, and following only the dictates of their own sweet wills in the matter of delays and catching cars. In speaking of the journey, Mr. Johnson said: "The whole thing has been delightful beyond our expectations. The constant change and variety of scenery has been an unalloyed pleasure, and there hasn't been a mile of tiresome passage in the whole distance. We have followed out our inclinations in everything. When the ladies were tired we stopped and rested. Our meals we got wherever opportunity permitted. Sometimes at a wayside lunch room, where ginger pop and potato chips were the principal delectations aside from sandwiches, to be had, or at the hotels where we stopped for the night. When we have seen all we want to, we shall return by rail, not because, however, the trolley ride isn't the pleasantest way in the world to travel—at least from Hackensack to Boston."

A VAST TROLLEY SYSTEM.—It is now formerly announced that the electric railways, city and suburban, of the Everett-Moore syndicate of Cleveland will be merged into a $150,000,000 corporation. Henry A. Everett and E. W. Moore, of Cleveland, are the projectors of the scheme, and they have secured a great deal of New York, Philadelphia, Boston and Detroit capital. This is the largest electric railway system in the world. The plan has been to secure city lines and build connecting suburban links. Over 25 different city and interurban lines have been acquired and gathered together to make up this great system. It includes the city lines in Port Huron, Mount Clemens and Detroit, Mich., and in Sandusky, Lorain, Cleveland and Akron, Ohio, and the interurban lines connecting them. The system already completed forms a belt almost around Lake Erie, from Port Huron, Mich., to Buffalo, N. Y., with lines reaching southward from the lake toward Cincinnati, Wheeling, W. Va., and Pittsburg. The mileage already completed and in operation in this system amounts to 1215, while over 400 miles of additional track are under construction and will be completed within the next year. The total earnings of the separate companies that comprise this system already amount to over $10,000,000 a year. It is estimated that these earnings will increase enormously after the roads have been connected and united under one management.

MONT BLANC ELECTRIC RAILWAY.—The height of Mont Blanc is about 15,000 ft., and it has been proposed to build a railway with an elevating shaft, to near to the summit, like that already carried out in part on the Jungfrau. The work is to be done in three sections; an open-air railway, a lower and an upper tunnel. The first is to start near the Sallanches-Chamounix line and to go along the left side of the Arve valley to Tacouney, 1100 metres above the sea, where the lower tunnel is to begin. The engineers propose that it should run on the left shore of the Tacouney glacier toward the peak Gros Buchar on the Aiguille du Gouter. There are no insuperable obstacles to this work, and at the various places the line can safely be laid in the open. The lower tunnel will be about 3½ miles in length, and end at an altitude of 3843 metres, where a hotel will be erected. The upper tunnel is to be in two parts, the first under the Dome du Gouter, 1½ miles long, ending at a height of 4363 metres. The second part will continue to the Great Plateau, under the Rochers des Bosses, and end at the Petits Rochers Rouges, 4580 metres above sea. The summit of the Petits Mulets is 110 metres higher and cannot be reached by rail on account of the ice, but will be gained by an elevator. The true summit is still 220 metres higher and must be reached on foot, or else by rope railway. The cost is estimated at 21,000,000 francs or, say, $4,250,000. The line will be an electric-rack railway, and the power is to come from the waters of the Arve. It is expected that travelers can be landed at the Aiguille du Gouter in July, 1902.

LETTER TO THE EDITORS.

"Wanted, A Volt."

To the Editors of Electrical World and Engineer:

Sirs.—From your editorial on page 1098 of Vol. 37, under the caption, "Wanted, a Volt," it seems that the necessity for such a constant is of utmost importance, especially so in view of the wide range of error that has been proved time and again to exist in a great number of switchboard instruments.

In the case of light and power plants operating under false conditions due to errors in voltmeters there must be a very appreciable effect in shortening the life of incandescent lamps when the voltage is too high, and a decidedly poor light when the voltage, through false registration, is maintained too low. A possible remedy, expensive, but easy of application, would be for manufacturers of electrical ap-

paratus and supplies to equip their traveling salesmen (when qualified) with standard voltmeters, and have them test and calibrate the voltmeters in the electric light and power plants they visit, and also explain to those in charge of the plants the necessity for proper measurement of current from the standpoints of greater efficiency and greater economy.

In the large cities, where the number of isolated plants goes into the hundreds, the opportunity for enterprise in the direction of establishing a business for testing and calibrating switchboard instruments and keeping them in proper adjustment, appears promising.

In the meanwhile, the country will perhaps wait for a "volt" until one is officially authorized by the U. S. Standardization Bureau.

WASHINGTON, D. C., B. C. WASHINGJON, JR.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

DYNAMOS, MOTORS AND TRANSFORMERS.

Calculation of the Stray Coefficient of Induction Motors.—HENBATH.—A communication in which he criticizes the formula of Jonas (Digest, June 22), which, he says, cannot be correct, as an important factor of straying has been neglected, while, on the other hand, a stray field has been assumed which, in reality, does not exist. He claims that the agreement between Jonas' theory and measurements is simply accidental.—*Elek. Zeit.*, June 20.

POWER.

Three-Phase Motor and Pump.—An illustrated description of a three-phase electric motor of Lahmeyer & Co., driving a triple-acting mine pump, which can raise from 35 to 420 cubic feet of water a minute to a height of 750 ft. to 900 ft. when running at 214 revolutions, the motor being supplied with 100 period three-phase currents at 500 volts. The power factor is 0.8 with a load of 75 horse-power.—*Eng'ing*, July 5.

REFERENCE.

Shaping Machines.—HAHN.—An article on the calculations of a flywheel for electrically driven shaping machines.—*Elek. Anz.*, June 20.

TRACTION.

The Storage Battery in Railway Power Station Service.—LYNDON.—He first discusses the effect of a storage battery on equalizing the load at a power station and the size of a battery for such use. He shows a typical load on a street railway power station, taken from actual practice. The minimum load is 800 amperes, the maximum 11,600 amperes, and the average 5740 amperes. The ideal condition would be to have the generators supply the average load, and the batteries large enough to care for all variations. In his case this would require a battery of about 4000 ampere-hours to discharge continuously for 14 hours, which would, of course, be out of the question commercially. To facilitate calculations, the writer shows in another diagram the coal consumed per 100 kilowatt-hours at various percentages of load, and the cost thereof at $3 per ton. A curve shows the variation and ampere-hour capacity of a battery with various rates of discharge. Another curve shows the amperes delivered continuously at varying discharge rates. A third curve shows the cost per kilowatt at varying discharge rates, and a fourth curve shows the variation in cost per ampere-hour at different discharge rates, the eight-hour rate being taken as 100 per cent. To have a definite basis for valuation, the discharges are referred to the three-hour rate. The cost of battery erected, exclusive of booster, is taken at $146 per kilowatt on a three-hour rating, or $73 at one-hour rate of discharge, and that of the generating equipment at $60 per kilowatt. The writer then divides the peak of the loads shown in the load diagram into small vertical divisions, the areas of which are taken and divided by the time over which the discharge extends and reduced to the equivalent three-hour rate. The summation of this will give the ampere-hour capacity of the battery required, which is shown to be 6615 ampere-hours. Where the batteries are used for storage of power principally and regulation is a secondary consideration, the compound booster is the type best adapted for the work. The writer then discusses the equipment of the plant on this basis, and shows the difference in cost between the storage battery and the equivalent of generating apparatus for carrying the peak of the load. He next considers the comparative operating cost with and without batteries. In the instance under consideration the saving is material. He concludes with a description of the proper type of boosters to be used with storage batteries.—*St. Ry. Jour.*, July 6, and Int. Ed., July.

Westinghouse Electric Brake and Car Heater.—This brake is a magnetic track brake which receives current from the car motors operating as generators. A coil of wire on the brake energizes the two track shoes, which on being attracted to the track force the wheel shoes against the wheels, making a double braking effect. One great advantage of the brake is that it draws the wheels closer to the track instead of tending to lift them off when the brake is applied. The current which used to energize the brake is passed through heaters in the car, and can thus be used for warming the people at no expense whatever. When the heaters are not used a rheostat is employed to absorb the current used on the brake. A special controller is used, having braking points thereon, or an auxiliary brake controller can be employed.—*St. R'y Jour.*, July 6, and Int. Ed., July.

Railways.—BRANDT.—A long communication referring to the article of Pforr (Digest, June 22). He does not believe that considerable advantage can be expected from graphical methods like that of Pforr. The reason is that certain simplifications made by Pforr, by neglecting some factors, do not seem justified, and that, in general, the exact method is much too complicated. He shows in a special example that this method leads to a wrong result.—*Elek. Zeit.* June 20.

Convention.—An account of the proceedings at the convention of the Street Railway Assoc'n of the Rhineland district, which was held at Aachen on June 7. The first question discussed was that of reducing the noise made by wheels on curves. One speaker had found that the noise was greatly reduced by substituting heavier axles. Forged spoke wheels with steel tires have been found less noisy than cast plate wheels. In Hamburg, on curves of short radius, the groove in the outer rail is made only 8 mm. deep, so that the outer wheel travels on the flange and not on the tire. This equalizes the travel of the two wheels to a large extent, and has greatly reduced the noise. The fear that this might cause derailing has not been realized in Hamburg. This practice is followed on curves of a shorter radius than 75 meters. Where the cause of screeching could not be removed, water and grease have been employed on the curves. Water is considered the best, and on some roads the wheels are greased by means of ropes soaked in fat and graphite, these ropes being lowered by the motorman as the car nears the curve. The subject of the removal of snow was also discussed, and the merits of track brooms and plows considered. For heavy falls of snow, plows were thought necessary.—*St. R'y Jour.*, July 6, and Int. Ed., July.

The New Manchester Tramway System.—Part of this system has recently been converted into an electric road, and is now being operated by power taken from the electric light company, and eventually the entire district will be traversed by electrically operated lines, new power stations built and Manchester be provided with one of the best English tramway systems. Several towns are taken in by the tramways, and each corporation will operate its line, satisfactory agreement having been made among them all.—*St. R'y Jour.*, July 6, and Int. Ed., July.

St. Louis.—The St. Louis Transit Co. is a recent consolidation of practically all the street railways in St. Louis. It is installing two large power houses to replace six smaller ones, and has an elaborate repair shop, which is the principal subject discussed. Different views are given of a machine capable of winding armature coils for different types of motors used. Other figures show a machine for winding an armature coil for a Westinghouse No. 56 motor, for a G. E. 800 motor, and for a Westinghouse No. 40 motor; further, a machine for winding the coils with tape, the tape being carried on a spindle; further, machines for winding field coils. One man with one of these

coil machines can wind 400 coils per day; also the methods of insulating and finishing the coils are described; also the method of testing the armature. The cost per car per month for maintenance and repairs varies between $10 and $40. The record during April was $26.45. This included labor as well as material required in making the repairs. Cars in regular use are washed every eight days, and at the same time are inspected and overhauled as much as necessary. One power station will have three 2250-kw direct-current generators; three 1500-kw and three 600-kw generators. The other will have two 2250-kw direct-current generators and two 1200-kw alternators and three 800-kw generators.—*St. R'y Jour.*, July 6, and Int. Ed., July.

Polyphase Transmission on the St. Louis & Suburban Railway.—An illustrated description. Owing to an increase in traffic, the company has decided to install two 1200-kw, three-phase generators with a condensing cooling tower and transformer stations with converter sub-stations at a cost of $270,000. One sub-station is already in use and another is being proposed. The voltage of transmission is 6600 volts at 25 cycles. The existing sub-station contains two 600-kw rotary converters and seven 250-kw transformers, three for each converter and one as a reserve. The transformers are cooled by a blast of air. The switching is all done on the high-tension side of the transformers.—*St. R'y Jour.*, July 6, and Int. Ed., July.

How to Make Non-Paying Roads Pay.—COOPER.—A continuation of his serial. He calls attention to the importance of making small improvements. An investment which would increase the earnings 5 cents a day would be worth the expenditure of $100, allowing 6 per cent for interest and 12 per cent for depreciation. He also calls attention to the advantage to superintendents of small roads of reading the technical papers, attending conventions and inspecting the practice of other roads. Special tools can now be secured for almost every operation required in street railway service, so that the practice of using makeshifts and thereby wasting time is not economical. —*St. R'y Jour.*, July 6, and Int. Ed., July.

REFERENCES.

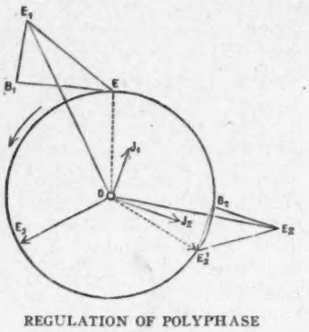
Buffalo.—Illustrated descriptions of the street railways of Buffalo and vicinity.—*St. R'y Rev.*, June 15.

Dundee.—A description of the tramway line of Dundee, Scotland, which has been recently put in operation and has about 50 cars. Current is taken at present from the local lighting station, but a power station is to be built of 1100-kw capacity.—*St. R'y Jour.*, July 6, and Int. Ed., July.

Syracuse.—CONNETTE.—A description of some of the improvements, particularly in the attitude of the corporation to the public, which have been made during the last two or three years in Syracuse. The various mechanical departments are conducted more according to the discretion of the several department chiefs rather than upon long and complicated reports which requires a great deal of time in their preparation.—*St. R'y Jour.*, July 6, and Int. Ed., July.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

Regulation of Polyphase Systems.—An illustrated description of a system of Feldmann of regulating both voltage and phase, of polyphase systems by means of a motor. This motor must have a number of phases different from that of the system to be regulated, in order to be able to render an unsymmetrical system, symmetrical. When an induction motor is used for this purpose, the property is made use of, that its slip can be varied and that it can be made to run as well as motor and as generator. The variation of the slip may be obtained by braking or by inserting resistance in the armature or impedance in the stator. The adjoining figure shows how an unsymmetrical three-phase system, E_1, E_2, E_3, can be made symmetrical by a two-phase motor when the single phases of this motor are regulated in the proper way. The currents of the two-phase motor are represented by $O\,J_1$, and $O\,J_2$. The diagram shows how the e. m. f.'s of the system and of the motor combine, so that a symmetrical three-phase system is obtained.—*Elek. Rund.*, July 1.



REGULATION OF POLYPHASE SYSTEMS.

WIRES, WIRING AND CONDUITS.

REFERENCE.

Equalization Mains.—TEICHMUELLER and EDELSTEIN.—Two communications, one by Teichmueller, in which he replies to Edelstein's criticism (Digest, June 1, May 4); the second, another reply of Edelstein.—*Elek. Zeit.*, May 23, June 13.

ELECTRO-PHYSICS AND MAGNETISM.

Electromagnetic Theory of Mechanics.—WIEN.—The leading tendency among electric theorists has been to reduce electromagnetics to mechanical conceptions and principles. This tendency, which is a consequence of the mechanical theory of all natural phenomena, is probably due to the idea that mechanical actions are somehow more real, palpable and intelligible than the play of electric and magnetic forces. This idea is, however, quite erroneous, since the intimate mechanism of a simple contact or impact is quite as mysterious as the attraction of two oppositely electrified bodies. The present author makes exactly the reverse attempt, namely, to reduce mechanics to electromagnetic conceptions and principles. He assumes, with Lorentz, that gravitation is due to the attraction between the ions composing the material bodies, and that the attraction between positive and negative ions surpasses the repulsion between ions of the same class. The ether is supposed to be at rest. Gravitational force must be propagated with the velocity of light, and must be modified by the motion of bodies. This, in the case of the fastest cathode rays, would involve a modification of 7 per cent. The other fundamental property of matter, viz., inertia, would be based upon electromagnetic inertia. "These speculations open up wide vistas in mechanics, which will put the theory to a very severe test."—*Ann. der Physik.*, No. 7; abstracted in Lond. *Elec.*, July 5.

Dynamical Theory of Heat and Light.—LORD KELVIN.—A very long illustrated paper on "Nineteenth century clouds over the dynamical theory of heat and light." The clearness of the dynamical theory is at present obscured by two clouds. The first came into existence with the undulatory theory of light, and involves the question: How can the earth move through an elastic solid, such as essentially is the luminiferous ether? He is afraid we must still regard this cloud as very dense. The second cloud is the Maxwell-Boltzmann doctrine regarding the partition of energy. He renders the mathematical verdict not proven, and the experimental verdict not true, and discusses at great length mathematical test cases of this doctrine.—*Phil. Mag.*, July.

Magnetic Effects of Electric Convection.—WILSON.—An illustrated paper "on the magnetic effect of electric convection, and on Rowland's and Cremieu's experiments." The magnetic effect of electric convection is a consequence of Maxwell's electromagnetic theory, and has been proved experimentally by Rowland and Hutchinson. As has been noticed in the Digest, Cremieu has recently made experiments, in which he failed to observe both the magnetic effect of electric convection and its converse, the electrostatic effect of magnetic convection, and had concluded that these effects do not exist. The present author shows that this conclusion is not warranted. He shows that in Cremieu's attempt to detect the electrostatic effect of a varying magnetic field, the effect of the steady magnetic field on the charging currents was left out of account, and that this latter effect is equal and opposite to the former; that, consequently, Cremieu's negative result constitutes an indirect proof of the existence of an electrostatic effect of a varying magnetic field, of the amount usually predicted theoretically; furthermore, that in Cremieu's attempt to repeat Rowland's experiment, his addition of a metallic screen placed close to the fixed sectors should cause a current to be produced which should almost entirely compensate the desired effect; finally, that Cremieu's partial failure without the additional screen, is quite possibly due to defective insulation of his sectors.—*Phil. Mag.*, July.

Anti-Coherers.—NEUGSCHWENDER.—An article in which he claims that the Schaefer "dry" anti-coherer, as described by Marx in an article noticed some time ago in the Digest, is of the same type as his own electrolytic anti-coherers. The Schaefer device consists of a silver-on-glass deposit gapped with a razor and covered with a layer of celluloid. Neugschwender's electrolytic anti-coherer consists of a similar gap moistened by breathing upon it. He says that in both anti-coherers the action is electrolytic. Marx's instruction to exhaust the air about the anti-coherer and readmit it, is inconsistent with the "absolute dryness" of the plate.—*Phys. Zeit.*, June 15; abstracted in Lond. *Elec.*, July 5.

MARX.—A reply to the article of Neugschwender. He endeavors to refute Neugschwender's criticism, and claims that the action in the

Schaefer anti-coherer is not electrolytic and therefore essentially different from the action in the Neugschwender coherer.—*Phys. Zeit.*, June 29.

Effect of High-Frequency Oscillations on Electric Resistance.—WHITE.—A Brit. Phys. Soc'y paper giving an account of an investigation made to find whether the action of light upon the electrical resistance of selenium, can be imitated by using high-frequency electrical oscillations. It is found that such oscillations permanently increase the resistance of selenium. The effect of a rise of temperature is to increase the resistance of a piece having a low resistance and to decrease the resistance of a high-resistance piece. The effects of the field in a piece of high resistance can be reversed by exposure to light or by reheating and subsequent cooling. In the case of tellurium a high-frequency field temporarily decreases the resistance, as also does a rise in temperature. Repeated heating and cooling of a piece of tellurium permanently increases its resistance. It seems probable that all of the effects are due to a rise of temperature caused by minute sparks within the mass. The rise in resistance by alternate heating and cooling may be due to the formation of tellurides with the metal of the electrodes. The large negative temperature effect of tellurium suggests that it might be usefully employed for the detection of heat radiation.—Lond. *Elec.*, July 5.

Thermopiles.—CAMPBELL.—A communication referring to the letter of Treichlinger, noticed in the Digest last week. He remarks that the gain in sensitivity, obtained by Treichlinger's arrangement is to some extent counterbalanced by the high resistance of the heated strip. He then discusses the question of the best metal or alloy to be used in conjunction with iron for such thermopiles. German silver, nickel, and constantan are, each of them, more or less suitable. The thermoelectric powers have the following relative proportions: Iron—German silver 100, iron—nickel 120, iron—constantan 190. With respect to thermoelectric power, constantan is therefore the best. There is, however, another factor upon which the sensitivity of the method also depends, i. e., the resistance of the thermopile. In this respect nickel has the advantage, but the negligible temperature coefficient of constantan is again much in its favor.—Lond. *Elec.*, July 5.

Dissipation of Electric Charges.—ELSTER and GEITEL.—They found some time ago that the conductivity of air for charges dissipated from a metallic body gradually increases in a confined space, tending towards a limited value. Since it is known that air free from dust conducts these charges better than dusty air, they suspected that the increase of conductivity in question might be due to the gradual laying of the dust in the confined space. They therefore made special experiments with artificially cleaned air. The attempt to produce the limiting conductivity by this process failed entirely. The time at which the maximum conductivity was attained could not be perceptibly shortened in this way. They then investigated the effect of moisture; but even such large variations of percentage moisture as from 91 per cent to 7 per cent did not produce a decided result. They now suggest the following explanation: All substances either contain traces of radio-active bodies or are themselves slightly radio-active, and the maximum conductivity is attained when the rays have had time to produce their full ionizing effect upon a certain quantity of air. The high conductivity of the air in closed cellars and in caves would tend to confirm this.—*Phys. Zeit.*, June 22; abstracted in Lond. *Elec.*, July 5.

Ionized Phosphorus.—BARNS.—A second paper on "The absorption of the ionized phosphorus emanation in tubes." He ascertains the precise conditions under which the phosphorus nucleus vanishes on passing through tubes at a definite velocity, or, in general, on being retained in any vessel, or put in contact with any barrier in a definite way, for a definite time. His experiments, presently described, thus relate to the absorption of condensation-producing atmospheric nuclei by surfaces or by suspended particles. They show that "such absorption takes place as though each nucleus of a nearly saturated region traveled in the entire absence of an electric field, with a velocity of about 3 millims. per second; or, if it be put roughly, that 1-3 of the total number travel in a given cardinal direction as though each nucleus had a velocity of about a centimeter per second. It is curious to note how close this lies to the velocity of the ion in a unit electric field."—*Phil. Mag.*, July.

Radio-Activity.—PEGRAM.—A good summary of the work done in this direction. He first gives a brief history of the discovery of radio-active substances, and then discusses the photographic and chemical effects, fluorescence, ionization of gases, penetrating power, deflection in a magnetic field, electrostatic effects, velocity, mass and energy of the radiation, secondary radiations. He concludes that for one component of the complex radiations a satisfactory explanation is offered. This component is of the same nature as the cathode rays, and consists of a rapidly moving stream of minute material particles, each having its charge of negative electricity. Another component is similar to the Röntgen rays, and is probably a phenomenon of the ether rather than of ordinary matter. Perhaps this component is produced by the action of the first component, as the Röntgen rays are produced by the action of the cathode rays. For the rest no satisfactory explanation has geen given. Possibly there is only a single primary radiation, the rest being secondary effects. The question of the source of energy in these radiations is yet unanswered.—*Science*, July 12.

Electric Dissipation at High-Altitudes.—EBERT.—The presence of ions in the air was suggested by the phenomena of photo-electric discharges observed by Elster and Geitel, and has been explained on the basis of the ultra-violet rays in sunlight. Ebert undertook two balloon ascents for the purpose of determining the conductivity of air at high altitudes. The general observation made was that, as the altitude increased, the ratio between the rates of discharge of negative and positive electrification became more and more like unity, and at the same time both rates of discharge showed a notable increase. But the excess of positive over negative ions may often be felt at altitudes as great as 8000 ft.—*Ann. der Physik.*, No. 7; abstracted in Lond. *Elec.*, July 5.

REFERENCES.

Absorption of Waves by Resonators.—ASCHKINASS and SCHAEFER.—An account of an investigation of the absorption of electric waves by resonators. They used as resonators strips of copper strung on threads in a frame, which were immersed in a bath of benzol, ether or acetone. They noticed a decided displacement of the maximum absorption.—*Ann. der Physik.*, No. 7; abstracted in Lond. *Elec.*, July 5.

Leyden Jar Discharge.—BROOKS.—An illustrated account of an experimental and theoretical investigation of the damping of the oscillations in the discharge of a Leyden jar.—*Phil. Mag.*, July.

ELECTRO-CHEMISTRY AND BATTERIES.

Electro-Chemical Formation of Alcaline Ferrates.—PICK and HABER.—A long paper by Pick, giving an account of an experimental investigation made to find under what conditions different kinds of iron, used as anodes in an alcaline solution, produce ferrates. Poggendorf already had found that ferrate is formed in a potassium hydroxyde solution at a cast iron anode, less at a steel anode, and not at all at a wrought iron anode. The present author shows that any kind of iron used as anode, forms ferrate, when properly treated for this purpose. But with a wrought iron anode some "coaxing" is of advantage, to form ferrate. To "coax" the iron, it is sufficient to use it alternatively as anode and cathode. Under such conditions any iron forms ferrate, while it is used as anode. On the other hand, only a very small portion of the ferrate is reduced, while the iron is cathode. But this treatment is not necessary at all. He found that any kind of iron, when used as anode in a very concentrated solution of potassium hydroxide with a very low current for a long time, will give a ferrate. The iron which has served for some time as an anode giving ferrate, is always of dark color and much less liable to rusting. This is evidently due to the formation of a layer of some oxide. Stirring is disadvantageous to the first formation of ferrate. If, however, an anode is used which has been well "coaxed" before, ferrate is formed and it makes no great difference whether the electrolyte is stirred or not. The amount of ferrate formed is greater in hydroxide of sodium than in hydroxide of potassium. The amount is the greater, the more concentrated the electrolyte. The amount of ferrate formed and of oxygen, gives together 100 per cent, ferrate not being formed primarily. A current density of 0.1 ampere per square decimeter yields in hydroxide of sodium 47 per cent of ferrate for cast iron, 26 per cent for steel, 14 per cent for wrought iron. In hydroxide of potassium 37 per cent for cast iron, 13 per cent for steel. 2 per cent for wrought iron. The higher the temperature the greater the amount of ferrate formed. (These results, if correct, enable one to draw the following conclusion regarding the Edison battery, which, however, is not mentioned in the article. As during charges and discharges the iron plate is alternately used as cathode and anode, there should be a tendency to the formation of the ferrate. This tendency would be greater with a solution of sodium hydroxide than with

potassium hydroxide. Edison uses the latter. Furthermore, it is to be assumed that Edison uses such an iron compound, which has a very small tendency to forming ferrate. Nevertheless the results, obtained by Pick, show that there would always be some danger of ferrate being formed, which would mean that the simplicity of the action of the new Edison cell would be lost. The new Edison cell would then be of the type of the old Edison-Lalande cell). At all temperatures between 0 and 70 degs., only ferrate and oxygen are formed at the anode. The output of ferrate is a maximum at 70 degs. At this temperature only a very small amount of oxygen is developed in the first moments of electrolysis. The relative amount of oxygen formed increases with the time, so that after 2 minutes about 90 per cent, and after 20 minutes about 80 per cent of ferrate are formed. The hot ferrate solution is slowly decomposed so that in the final solution there is some ferrite besides the ferrate. The article of Pick is concluded by some theoretical conclusions regarding the potential difference between the iron electrode and the electrolyte. There is also a brief supplementary paper, by Haber, on the ferrite solutions. It is chiefly of interest chemically.—*Zeit. f. Elektrochemie,* June 20.

Edison Battery.—DELASALLE.—An article in which he says that the Jungner accumulator is of the same type as the new Edison battery, as it is also an "oxygen-lift," and that nickel has been used for battery plates by Michalowski in his nickel-zinc battery. Attention is called to the difference in writing the formula of the higher nickel oxide by Michalowski and Edison. It is said that the comparatively low discharge voltage of 1.1 may have disadvantages, especially on automobiles, where the space is limited. "The best is to wait for the exact results and improvements, before pronouncing a definite opinion."—*L'Ind. Elec.,* June 25.

Electro-Deposition of Alloys.—LEHFELDT.—The methods which have been proposed for the practical preparation of alloys by electrolysis may be grouped into two classes, according as the metals forming the alloy are deposited together, or one of them is used in liquid form as cathode, the other being deposited on to it. The latter process is well known as a method of preparing amalgams. It has also been used by Walter for obtaining alloys of lead by using an electrode of melted lead under fused salts. These processes require certain precautions, as continuous stirring and security against oxidation. This method, however, requires impractically high temperatures in many cases, and therefore Walter proposed to take advantage of the fact that the melting point of an alloy is always lower than that of the pure metals composing it. If the temperature of the fused salts composing the electrolyte be kept below the melting point of the cathode metal when pure, but above that of the alloy to be formed, then the cathode metal can be used in the solid form, and as it alloys it will fuse off, and expose fresh surface to be alloyed. This process was actually carried out for the preparation of a silicon-bronze. Here copper is used as a cathode, and since silicon cannot be liberated directly it was obtained by the reduction of a silicate by sodium. The electrolyte therefore consisted of sodium silicate—to which sodium chloride or other salt was added in order to lower the melting point—and the temperature maintained above the melting point of the desired alloy. The copper cathode and carbon anode were both inserted into the electrolyte from above. On passing a current, sodium is produced at the cathode. This reduces the silicate, and the silicon formed alloys with the copper. The silicon-bronze melts and falls to the bottom of the vessel, exposing a fresh surface to the action. He then makes some theoretical remarks on the production of an alloy by electrolytically depositing both metals simultaneously. Practice is here ahead of theory. He gives some information about the method of Baker of producing brass and of the process of Cowper-Coles of producing cadmium silver alloys. He finally gives a note on iron. It had been thought that electrolysis offered a means of preparing perfectly pure iron. That is far from being the case, however, as hydrogen is always deposited along with it. Houllevigne found that the most favorable conditions for this were the use of a mixture of ferrous chloride and ammonium chloride as electrolyte, and a somewhat large current density 40 milliamperes per square cm. In this way he obtained very regular deposits containing about 1 atom of hydrogen to 12.5 atoms of iron, and the metal thus prepared possessed the properties of a cast iron, or hard steel—hardness, specific resistance, magnetic qualities, etc.; indeed, he attributes the quality of steel, as distinguished from soft iron, rather to the structure of the molecule, as determined by the proportion of foreign matter present, than to the nature of the foreign matters. Later he found that under some circumstances it is possible to obtain carbon also in the electrolytic iron.—*The Electrochem and Met.,* June.

Alloys Made in the Electric Furnace.—SARGENT.—An article on the production of alloys of tungsten and of molybdenum in the electric furnace. Alloys of tungsten and molybdenum with nickel, cobalt and chromium were made by heating the dioxides of these metals in an electric furnace with carbon. The amount of carbon used exerted a greater influence in the purity of the metal than did variations in the strength of the current and the duration of its action. The product invariably contained traces of carbon and unreduced oxide. Tungsten did not form alloys with bismuth and manganese, while molybdenum alloyed with both of these metals, but would not alloy with copper, which combined readily with tungsten. Neither metal would alloy with tin.—*Jour. Am. Chem. Soc., 22,* p. 783; abstracted in *Tech. Quart.,* June.

HAMILTON and SMITH.—Metallic masses, composed of mixtures of various elements, contaminated with iron, carbon, silicon and "gangue" were obtained by heating the oxides with carbon and iron or copper in a special form of electric furnace. The properties of these metallic masses were not studied.—*Jour. Am. Chem. Soc., 23,* p. 151; abstracted in *Tech. Quart.,* June.

Acetylene as Anodic Depolarizer.—COEHN.—A German Electrochem. Soc'y paper, in which he gives an account of an investigation made by him and Billitzer on the "electro-chemical behavior of acetylene." Le Blanc's "method of decomposition voltages" was made use of, which consists essentially in measuring the current that goes through a cell while the voltage at the terminals is varied. The results are plotted in curves, with the current and voltage as ordinates. A sharp bend or corner in such a curve indicates that at that point a new chemical process sets in. As long as the voltage at the terminals of a cell is below the e. m. f. required for decomposition, only a very small current ("Reststrom") goes through the cell. When the voltage is then raised the current increases rapidly and suddenly, as soon as the e. m. f. required for decomposition is reached. If, however, another material (depolarizer) is added to the electrolyte it can be effected that the sudden rise of the current sets in before the e. m. f. required for the decomposition of the electrolyte alone is reached. The curve obtained with an aqueous solution of potassium hydroxide (evidently with inert electrodes) shows that the decomposition voltage is a little below 1.7 volts. When, however, acetylene was passed along the anode, the curve already shows a sharp bend at 1.22 volts. This indicates that a chemical process is then setting in. They found that formic acid is produced and that the amount is in agreement with Faraday's law as long as the voltage is between 1.22 and 1.7 (1.7 is the decomposition voltage). For higher voltages, the amount of formic acid produced becomes smaller than calculated from Faraday's law. They further experimented with normal sulphuric acid. When acetylene was passed along the anode, a bend of the curve was again found at a point below the decomposition voltage of sulphuric acid; but the point where this bend occurred was not so well defined, as in the former case of potassium hydroxide. It was found that in this case not formic acid, but acetic acid was produced.—*Zeit. f. Elektrochemie,* June 6.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Simplified Liquid Interrupter.—GOLDHAMMER and ARISTON.—A description of a new arrangement of Caldwell's (or Simon's) interrupter, which appears to have some distinct advantages. The porcelain diaphragms are represented by the walls of porcelain beakers. The wall is bored down until it is thin, and then a small hole is punched into it by a light tap with a hammer on a needle. This makes holes from 0.2 to 0.4 mm. wide, with walls a few tenths of a millimeter thick. The durability of the porcelain is something quite extraordinary, and indicates porcelain as the ideal material for interrupters of this kind. The beakers used by the authors are 10 cm wide and 10 cm high. This insures that for ordinary currents there is very little heating of the liquid. To still further reduce the heating, they use two or more cells in parallel, joining the inner vessels with a siphon. If the current passes in opposite directions in the interrupters, any change of level in one of the inner vessels will be compensated by a rise or fall of the liquid in the other. As a further advantage, the resistance of the interrupter is diminished. No cooling device is needed in this arrangement. The liquid is covered with a layer of vaseline oil. The cost of the apparatus is trifling.—*Phys. Zeit.,* June 22; abstracted in Lond. *Elec.,* July 5.

REFERENCE.

Power Measurement in Polyphase Circuits.—J. A. Fleming.—A very clear, systematic discussion, illustrated by diagrams, of the methods of measuring power in polyphase circuits.—Lond. *Elec.*, July 5.

Telegraphy. Telephony and Signals.

REFERENCE.

Submarine Telegraphy.—Janlin.—An illustrated description of a receiver for submarine telegraphy, devised by Ader.—*Jour. Teleg.*, June 25.

New Books.

Inventor's Manual. How to Work a Patent to Make it Pay. Revised and enlarged edition. New York: Norman W. Henley & Company. 115 pages. Price, $1.00.

This is an anonymous work, and the author explains in his preface why he does not reveal his identity. He says: "The principal reason is, that if he were to do so, he would be overwhelmed with applications for further advice, and for assistance in selling patents."

The author gives some eminently sound advice to inventors. He says: "The first thing to be done, therefore, is to invent something that the mass of the people want." He quotes Burns's lines, "O, wad some pow'r the giftie gie us," etc., and further says: "If an inventor is able to forget himself to such an extent as to look upon his invention with unbiased eyes, it may appear in a new light to him." This certainly is good medicine for the typical inventor, and we sincerely hope he will take it; that is, some inventors, for we know that the bulk of the species never will, any more than a leopard will change his spots.

Further along in the book the author tells how to sell a patent, giving some worldly advice to the inventor to guard him against the wily capitalist's attempt to "do him up." This advice does not appeal to us as forcibly as the other; some of it, indeed, is of a kind that an honorable inventor would not countenance. Of course, a purchaser tries to buy a patent as cheaply as possible, like other property; and if an inventor does not make a satisfactory bargain, it is not due so much to the fact that the purchasers of patents are especially grasping or unscrupulous, or that inventors are an abused and downtrodden class, as to the real uncertainty of the value of the patent. A patent has no market value, and in consequence more business talent is required to sell it advantageously than, say, a piece of real estate. It frequently happens that there is only one possible purchaser for a patent; more frequently no purchaser at all. In the first case the purchaser is very likely to have at least as much to say about the price as the vendor has, and if his ideas of the value of the invention are extremely circumscribed, he is accused of grinding the face of the poor inventor; while if he flatly refuse to buy at any price, the inventor is certainly no better off, yet he does not accuse the other of dishonesty. Again, the shady practices are not all on one side; we have known inventors whose standard of ethics was not that of a Marcus Aurelius.

The author tells how to form companies, gives legal forms for assignments, licenses, shop rights, etc., and finishes the volume with a table of the population of the States and counties compiled from the twelfth census of the United States. This table is intended to show the relative values of territorial rights.

BOOKS RECEIVED.

Die Beleuchtung Von Eisenbahn-Personenwagen. Mit Besonderer Berucksichtigung der Elektricitat. By Dr. Max Buttner. Berlin: Julius Springer. 134 pages, 60 illustrations. Price, 5 marks.

New Transformers for the Castner Works at Niagara Falls.

The Castner Electrolytic Alkali Company, at Niagara Falls, has just installed 22 100-kw transformers, which were furnished by the Wagner Electric Manufacturing Company. The two features of special interest about this installation are the provisions for discharging the air from the transformer air blast into the outside air through an exhaust duct, and the wide variation in voltage that is obtainable from the secondary circuits. The transformers are used to supply a set of 11 400-kw Westinghouse rotary converters. As these rotaries are used on electrolytic work and require considerable variation in voltage the transformers had to be provided with regulating heads, or a number of primary terminals, for cutting in or out part of the primary so as to vary the secondary voltage.

The primary voltage is constant at 2200 volts, and the secondary voltage must be varied by increasing or decreasing the number of turns on the primary to give a secondary voltage of from 148 to 181 volts. To do this, a regulator dial having fourteen steps is used. One revolution of the contact arm around the dial cuts out coils enough to increase the voltage only half of the maximum 33 volts. When that has been done, the voltage is still further increased by moving the regulator arm around to its original position with no coils cut out, and cutting out an equivalent number of turns on another part of the primary coil. The regulator arm then can be moved around to cut out the balance of the primary regulating coils and increase the secondary to its maximum of 181 volts. The regulating dials, rotary transformers and switchboards in the plant are Westinghouse make.

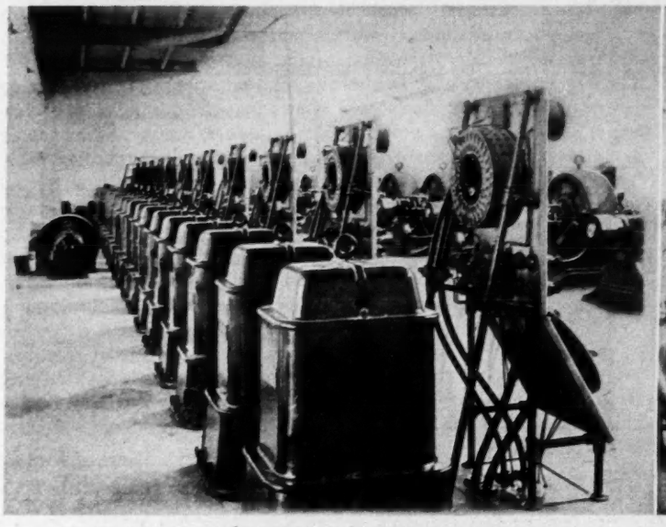


FIG. 1.—NEW TRANSFORMERS.

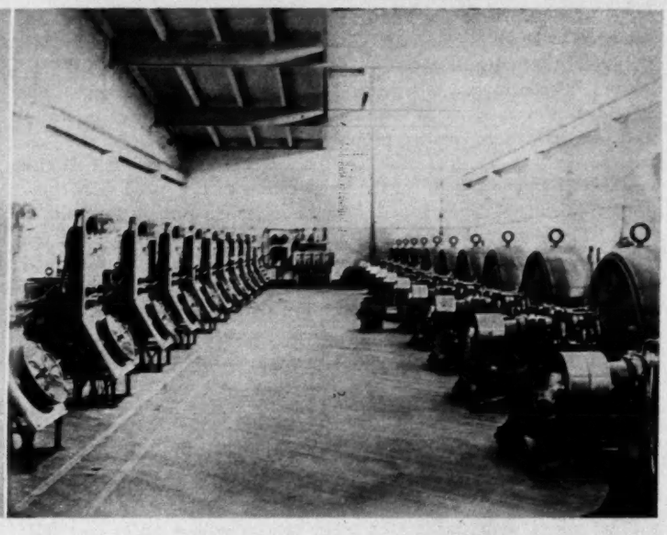


FIG. 2.—ROTARY CONVERTERS AND REGULATORS.

The new lot of 22 Wagner transformers have air blast for ventilation, and in their construction and installation, the decided improvement is introduced of discharging the air into an exhaust duct after passing through the transformers. By doing this the exhaust air can be used to heat the room as usual in such plants in winter and in summer can be turned into the outside air instead of discharging into the room and raising it to a temperature uncomfortable to the workmen and detrimental to both transformers and rotary converters, as a high room temperature decreases the chance for radiation. Both supply and exhaust air ducts are run the length of the transformer room from a fan blower near the center. Each transformer is mounted on a sub-base, divided into two parts by a partition. The inlet main is piped to one chamber, the exhaust main to the other.

The air passes up through one-half of the transformer and down through the other half to the exhaust chamber. The inlet duct for the eleven transformers located on one side of a blower is 29½ by 20 inches. The wires are all taken out from below and no wires appear above the transformer. They pass out of the air ducts through bushings filed with pitch compound to prevent leakage of air.

In this plant the rotaries are started from each other by belting from one to another on the tight and loose pulleys shown on the ends of the shafts of the rotaries, one of the rotaries being first started by belt from the small induction motor seen.

To give the armatures of the rotaries end play, they have all been equipped with electromagnets acting on one end of the shaft. The

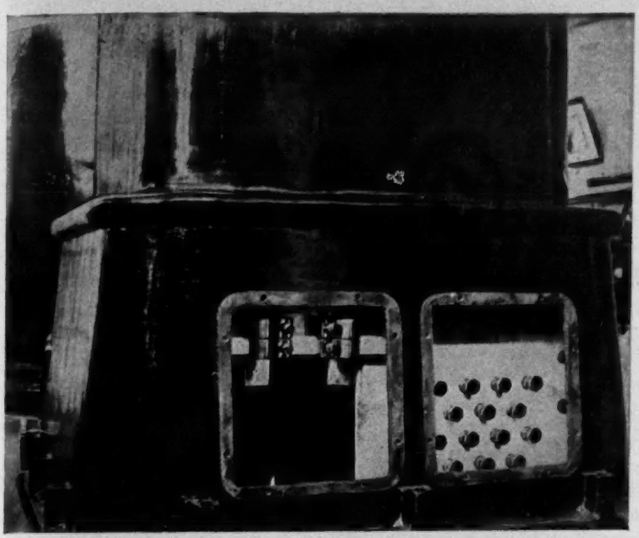


FIG. 3.—TERMINAL BOARDS ON TRANSFORMERS.

circuit through all these is closed at intervals of three or four seconds by a make and break device consisting of a pair of carbon contacts, a solenoid and a dashpot.

Leich Four Party Line Selective Signaling Station.

A new four-party line selective signaling system is now being placed upon the market by the Metropolitan Telephone & Electric Company, of Chicago, Ill. It is the invention of Mr. Oscar M. Leich, general manager of the above company. The demand for such service has been a continually growing one, especially among independent telephone exchanges, the requirements being that the party line signal be adapted for ringdown or common battery systems, and shall

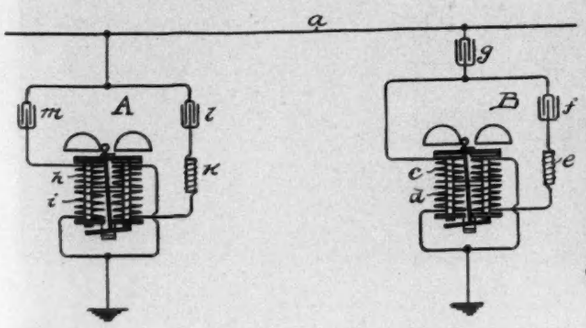


FIG. 1.—BELL CIRCUIT.

permit the inclution of condensers in circuit to stop the battery flow.

The Leich party line is operated by alternating currents of two different frequencies. Two bells corresponding to each frequency are used, the ground being used as return conductor, so that four bells may be operated from the two lines of a metallic telephone circuit. The system is not a step-by-step method, and is operated altogether without springs. It therefore needs no adjustment. Condensers may be included to stop the battery flow, and the only additional apparatus necessary is a small impedance coil which may be placed within the bell box on one side of the ringer magnets so as not to occupy additional space for the telephone instrument.

The ringer magnets of each set are provided with two windings differentially connected in in a derived circuit, each one being strong

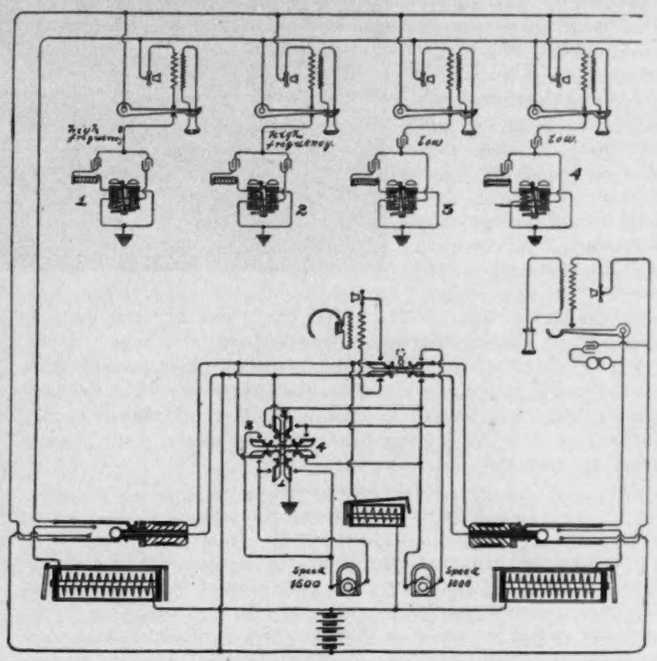
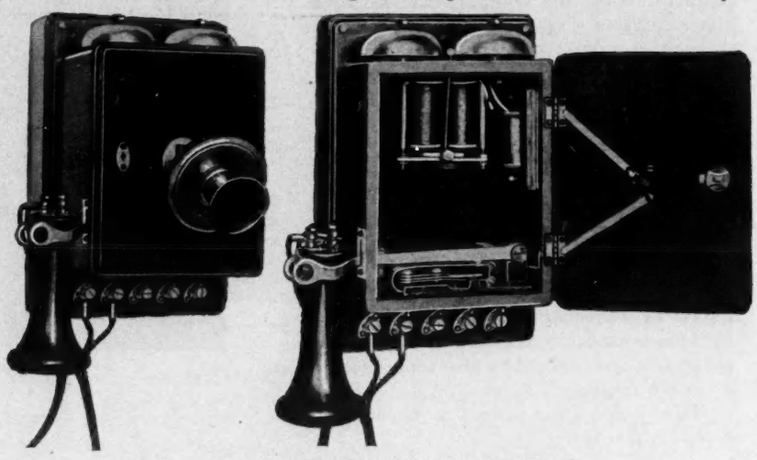


FIG. 2.—DIAGRAM OF CONNECTIONS.

enough to operate the bell. Alternating currents of two frequencies, preferably 16 and 26, are utilized. As the bells are responsive to currents of different frequency only, neither line resistance, inductance nor capacity, in the quantities met in practice, can influence successful operation, it is said, thus adapting the bells for underground cable work and long-distance toll lines.

In order to adapt the system to a four-party line ringing system a high-frequency and a low-frequency bell are each associated with one limb of the metallic telephone circuit and the ground. In the sketch (Fig. 1) there is shown a high-frequency bell at *A*, and a low-frequency bell at *B*, both bells being connected to one conductor *a* and the ground. The low frequency bell is provided with two windings *c* and *d*, each ringer magnet containing one-half of each winding. The two windings are in parallel, and are differentially



FIGS. 3 AND 4.—SELECTIVE SIGNALING TELEPHONES.

connected. An inductance coil *e* and a condenser *f* are in series with a winding *d*, the inductance *e* neutralizing the capacity *f* on the high-frequency. A condenser *g* is placed in series with the two bell windings to stop the battery flow. A high frequency current will not operate this bell, as the current divides equally through both windings. If a low frequency is impressed on the bell windings,

nearly all of the current will flow through the winding *c* and operate the bell, as the impedance of the circuit containing the winding *d* is very high at this frequency. The high-frequency bell is provided with two windings, *h* and *i*. The winding *i* is in series with an inductance coil *k* and a condenser *l*. The winding *h* is in series with a condenser *m*. If a high-frequency current is impressed on the bell winding most of the current will pass through the winding *i*, as the condenser *m* prevents the flow thereof through the winding *h*. A low-frequency current when impressed on this circuit will divide equally through both windings and not operate the bell.

Fig. 2 shows a complete telephone system provided with bells constructed in accordance with those shown in Fig. 1. The two generators which are utilized to furnish the low and high-frequency current are desirably at speeds of 1000 and 1600 r. p. m. Figs. 3 and 4 illustrate the apparatus itself.

A New Telephone System.

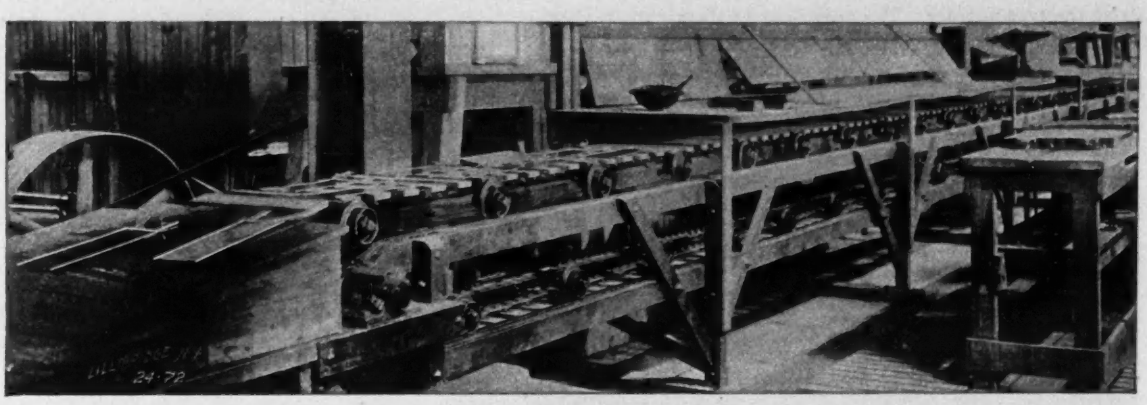
Our Canadian correspondent writes that a new telephone system invented by Mr. Thomas Paul, an electrician of the little town of Yorktown, Assiniboia, N. W. T., may effect a revolution in the methods and economy of existing systems, particularly as applied to the establishment of "lines of communication" between farmers in the vast prairie lands of the West, and at great distances apart. The inventor two years ago established at Yorktown a telephone line upon what was then an entirely new system, into which he introduced several original and economic features. This system gave such universal satisfaction that Mr. Paul, as a further experiment, completed last winter a trunk line of 30 miles in length to the north of the town and supplied the farmers of that district with communication with Yorktown and with each other. It is the first farmers' line in Canada. A joint stock company is now being formed to extend this system, which, in some respects, is similar to the mutual systems in vogue in some parts of the United States.

Among the novelties of the system are a battery, situated at central, working on open circuit and ringing both subscriber and central alike. The subscriber simply lifts his telephone and is at once in connection with central; or if the central operator has not the telephone at his ear, then an indicator is actuated. One indicator only is required for each section of, say, 100 subscribers, and yet no difficulty or confusion is occasioned thereby. The system uses the metallic circuit, and yet only single plugs and cords are required to give connection; no ringing or listening keys are required; no instruments, other than the subscribers' sets are in circuit, consequently speaking is loud and clear. Subscribers are constantly in connection with central who, however, does not overhear conversation. Only three simple actions are required to give connection. There are other advantages attached to the system. Mr. Paul has applied for patents in Canada and the United States to cover his invention.

Conveyor in Storage Battery Factory.

In the manufacture of storage batteries, the transporting of the plates from one department to another represents a laborious proposition. The leaden plates are not only heavy, but must be handled carefully. The accompanying illustration is from a photograph of an interior view in the works of the Electric Storage Battery Company at Philadelphia, and illustrates the method there in vogue for transporting "Chloride Accumulator" plates.

This conveyor is known as a "Roller Apron Conveyor," and is another application of the labor-saving devices utilizing what is familiarly known as link-belting. The equipment was designed and installed by the Link-Belt Engineering Company, of Philadelphia.



VIEW OF CONVEYOR.

The Largest Storage Battery Cell in the World at the Pan-American.

The chief feature of the Gould Storage Battery Company's Pan-American exhibit is the big storage battery cell, which is the largest constructed up to date. The cell has 50 positive plates and 51 negative, 15½ by 31 inches, which is the standard central station size used by this company. The plates are the same as used on the competitive test at Cincinnati some time ago. The rating of this big cell is 2000 amperes for eight hours' discharge, 4000 amperes for three hours, and 8000 amperes for one hour. This cell requires, of course, unusual provisions for charge and discharge, as it is shown in actual operation at the exposition. A switchboard with sufficiently heavy conductors and a small motor-driven dynamo of 2.6 volts e. m. f. are provided for charging. The cell is in a lead-lined wooden tank, and weighs complete 8750 lbs. The exhibit also includes a complete line of cells and plates for automobile and other purposes. The plates of the Gould batteries are electro-chemically formed, but before forming are ribbed so as to give about 17 times the surface a flat plate would give. In forming the active material is "grown" chemically out of the lead of the plate itself. No antimony or other metal other than lead is employed in the plates, and this does away with much of the danger from local action between different parts of the plate itself.

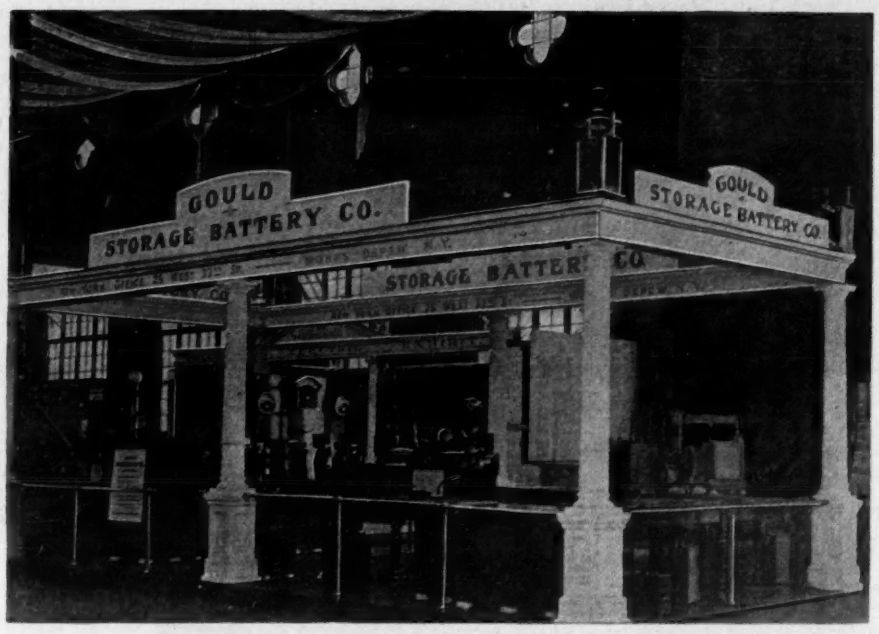


FIG. 1.—STORAGE BATTERY EXHIBIT.

In the vehicle battery the same general construction is followed as in the station cells, but all parts are, of course, made lighter in pro-

portion to their output. The active material of the Gould battery covers the plate in a thin layer and better diffusion of the electrolyte

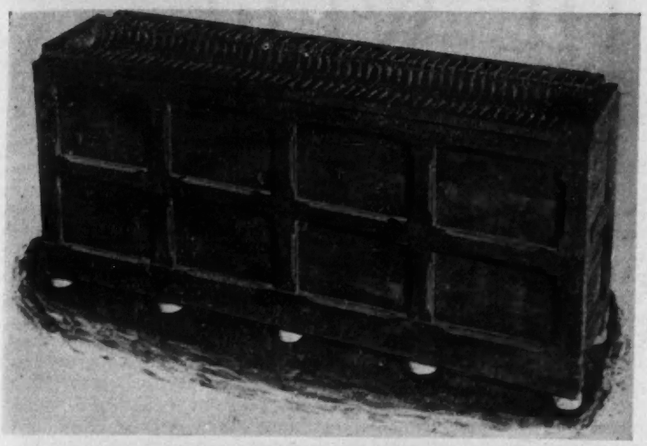


FIG. 2.—A STORAGE CELL.

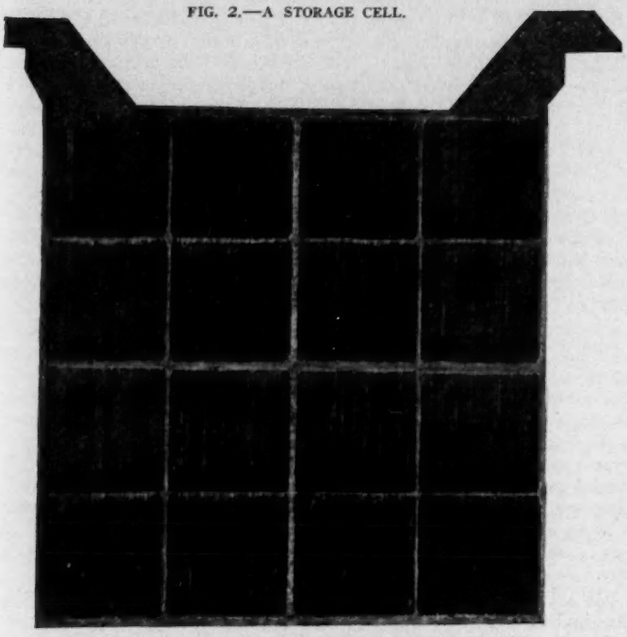


FIG. 3.—ONE OF THE PLATES.

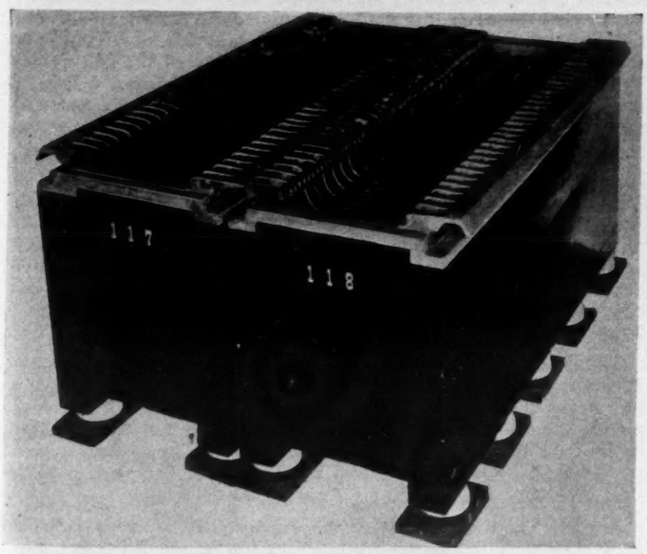


FIG. 4.—TWO STORAGE CELLS.

and higher efficiency are possible than where large masses of active material must be penetrated by the acid.

Advantages of Mechanical Draft.

In a recent article Mr. Henry C. Meyer, Jr., states that draft produced by fans possesses many advantages over chimneys as ordinarily proportioned. Probably the greatest of these is its flexibility, it being possible to regulate the speed of the fan so that the proper rate of combustion for the amount of steam required is maintained entirely independent of the weather conditions. Another important advantage is the ability of the fans to create a much greater draft than is possible with a chimney. Steam engines for driving fans are frequently fitted with valves arranged to govern the speed of the engine, according as the boiler pressure varies, increasing it as the pressure falls and reducing it as it rises above the normal. Mechanical draft enables economizers to be placed in the flue to heat the feed water, thus reducing the temperature of the escaping gases far below the temperature that is necessary in a chimney to create a draft. The reduction in draft due to the use of economizers is a much greater percentage of the available draft with a chimney than it is of the draft where fans are employed. Again, the greater draft of fans enables cheap low-grade fuels to be burned that could not easily be used with chimney draft, and the saving that these fuels bring about in some localities is a very considerable sum of money. Still another point in favor of mechanical draft lies in the portability of the fans in case a change of location is desired.

Brooklyn Bridge in Buffalo.

One of the most attractive exhibits at the Pan-American is that of the John A. Roebling's Sons Company, of Trenton, N. J., on the north side of Machinery Hall. In its exhibit the company has a small 24-ft. model of the Brooklyn Bridge, true to scale, being the same as that exhibited by it at the Paris Exposition. It is accompanied by a section of the cable used on the bridge, and a section of the cable that is to be used on the new East River bridge. The back of the exhibit is made up of a huge stone model tower, being a strikingly faithful representation of the Brooklyn tower of the New York and Brooklyn Bridge, with a painted background showing the remaineder of the bridge and New York City in perspective. The concern shows all kinds of electric light and power cables, paper and rubber insulation, lead encased, from 110 volts single conductor to a

EXHIBIT OF WIRES AND CABLES.

four-conductor paper insulated cable that stood 50,000 volts; dry paper insulated telephone cable, 10 to 200 pair; bare iron and copper telephone and telegraph wire, also rubber and weatherproof insulated, of the same materials for the same purposes, and all kinds and sizes insulated electric light wire and cords, reinforced show window cord, as well as iron wire.

A very unique and novel feature in the furniture are the chairs which it made in its own shops, being the two ends of a cable reel, with a seat placed where the "barrel" of the reel usually is. The center table and desk chair are made of a reel of cable also. The writer found the chairs fully as comfortable as they are odd and original.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Call money at the close was quoted at 2½ per cent, and sixty-day loans at 4½ per cent. In the stock market there was a rise in the early part of the week, but a reaction resulted on easier money, the appearance of rain in the West and the announcement of the new directorate which will control Northern Pacific in the joint interest of leading financiers. Prices, however, are generally higher than they were the week previous, but public participation in speculation was not apparently increased. The United States Steel stocks were supported in the face of the strike, and after a sharp decline on heavy liquidation of speculative holdings, rallied more or less. Traction stocks were firm, although activity in them decreased when the rest of the market became buoyant. Brooklyn Rapid was favorably affected by reports of increased earnings, and closed with a net gain of ⅞, the total sales being 54,750 shares. Metropolitan Street Railway showed better results, closing with a net gain over the week previous of 2¼ points. The sales for the week aggregated 15,450 shares. In the electric stocks General Electric heads the list of advances, closing with a net gain of 6 points, the sales being 6450 shares. Western Union participated in the general advance and closed with a net gain of 1¾. American District Telegraph dropped off 6 points as compared with the last quotation. The outside market did not exhibit any prominent features. Prices are fractionally changed in some instances. Electric Boat shows an advance of 2 and 3 points on the common and preferred, respectively, the rest of the list being practically unchanged. Following are the closing stock quotations:

NEW YORK.

	July 13.	July 20.		July 13.	July 20.
American Tel. & Cable...	—	100	General Electric.....	249	255
American Dist. Tel.....	—	34	General Carriage.....	1⅞	1½
Brooklyn Rapid Transit..	76¾	77¼	Hudson River Tel.....	120	120
Commercial Cable.....	183	—	Illinois Elec. Veh. Trans.	⅝	⅝
Electric Boat.....	15	17	Metropolitan Street Ry...	166	168¼
Electric Boat pfd.....	40	43	N. E. Elec. Veh. Tran...	3	3
Electric Lead Reduc'n....	1⅞	1⅞	N. Y. Elec. Veh. Tran...	11	11½
Electric Vehicle.....	9	9	N. Y. & N. J. Tel.....	172	170
Electric Vehicle pfd.....	17	16	Tel. & Tel. Co. of Am....	4	4
			Western Union Tel.....	90	91⅞

BOSTON.

	July 13.	July 20.		July 13.	July 20.
Am. Tel. & Tel.....	154⅜	163	Mexican Telephone.....	2½	2⅛
Boston Electric Light....	—	—	New England Telephone..	—	—
Erie Telephone.....	49	48	Westinghouse Elec.....	68½	67
General Electric pfd.....	—	—	Westinghouse Elec. pfd..	79½	*79½

PHILADELPHIA.

	July 13.	July 20.		July 13.	July 20.
American Railways.....	39½	39½	General Electric Auto....	—	—
Electric Storage Battery..	—	85	Philadelphia Electric.....	4¾	5⅝
Electric Storage Batt'y pfd	86	88	Pa. Electric Vehicle.....	—	1
Elec. Co. of America.....	6¾	6½	Pa. Elec. Veh. pfd.....	—	1

CHICAGO.

	July 13.	July 20.		July 13.	July 20.
Chicago Edison.....	176	176	National Carbon pfd.....	86	86½
Chicago City Ry.....	205	206	Northwest Elev. com.....	44	45
Chicago Telep. Co.....	275	*275	Union Traction.....	16	17½
National Carbon.....	16½	16½	Union Traction pfd.....	58	58

*Asked.

NEW ENGLAND TROLLEYS.—A syndicate composed largely of Boston people have organized the Hartford & Springfield Street Railway Company to connect the two cities of Hartford and Springfield by electric road, 25 miles in length, entering Springfield over the tracks of the Springfield Street Railway Company, and entering Hartford over the tracks of the Hartford Street Railway Company. The capitalization of the new company will be $375,000, 5 per cent, 20-year bonds, and $375,000 stock. All the securities have been placed. Messrs. Tucker, Anthony & Co. are superintending the construction, which will be of the very highest type for high speed. Springfield has a population of 63,000 people and Hartford 80,000. The new route will run through Thompsonville, which will shortly have a population of 20,000. All the electric roads in and around Springfield are paying 8 per cent dividends, except one or two new properties, and the earnings of the Hartford & Springfield road are estimated at 6 per cent on the capital stock at the end of the first year. At the present time it takes one hour to travel by steam road between the two cities, with the exception of one or two expresses, which make it in 45 minutes. The fare is 50 cents, whereas the fare by the Hartford & Springfield road will be 30 cents from any part of Springfield to any part of Hartford, and the running time will be 1½ hours.

INTERSTATE TELEPHONE.—A certificate was filed with the Secretary of State of New Jersey increasing the capital stock of the Interstate Telephone Company, a New Jersey corporation, from $100,000 to $5,000,000. This company was organized about three months ago, and at a meeting of the stockholders held in Trenton early last week the increase in capital stock was agreed upon. The president of the company is Hugh H. Hammill, president of the Trenton Trust & Safe Deposit Company. Among the New Jersey men interested in the company are State Controller Hancock, County Clerk Parker Gummere, of Trenton; Congressman Loudenslager, Colonel A. R. Kuser, and Hamilton Kean. The company has already acquired a number of independent telephone lines in New Jersey, including those in Trenton and Paterson, and is negotiating for the independent companies in Camden and Atlantic City. Its plans have already been noted in these pages.

DIVIDENDS.—The Coney Island & Brooklyn Railroad Company has declared its regular quarterly dividend of 2½ per cent on its capital stock, payable Aug. 1. The directors of the National Carbon Company have declared the regular quarterly dividend of 1¾ per cent on the preferred stock. The Bell Telephone Company, of Philadelphia, has declared a dividend of 2 per cent, payable July 17. The United Traction Company, of Albany, has declared the usual quarterly dividend of 1¼ per cent, payable Aug. 1. Books close July 20. The earnings for the quarter, owing to the recent strike, showed a deficit of $50,000; hence the above dividend was declared payable from the company's surplus. The Twin City Rapid Transit Company has declared a dividend of 2 per cent upon its common stock, an increase of ½ of 1 per cent over the previous declaration, payable Aug. 15.

TELEGRAPH CONSOLIDATION.—The following item about the "old, old story," not of salvation, but of consolidation, is from the New York *Times:* "George Gould and John D. Rockefeller are now credited in Wall Street with being the moving spirits in the telegraph and telephone combine about which lately there has been in the Street so much talk. It is said that these gentlemen have for some time past been buying not only all the Western Union stock offered in the market, but also by private sale the stocks of other telegraph and telephone companies. As the gossip runs, the merger is to be made along the lines of the Steel Trust combination." If this is only repeated often enough, the shepherd boy will find it is true.

BIRMINGHAM CONSOLIDATION.—The stockholders of the Birmingham Railway, Light & Power Company, which recently absorbed the Birmingham street car lines, the Birmingham Gas Company, and the Consolidated Electric Company, have authorized an issue of $6,000,000 of bonds on the consolidated property. Arrangements have been made for these bonds to be floated by the Old Colony Trust Company, of Boston. H. M. Atkinson, of Atlanta, who arranged the consolidation deal; Gordon Abbott, of the Old Colony Trust Company, and Isadore Newman, of New Orleans, will be in the new board of directors. Two million dollars will be expended by the syndicate in improvements of systems.

WINDING UP NEW ENGLAND ELECTRIC VEHICLE.—The New England Electric Vehicle Company has declared a dividend of $2.50 on each share of stock on which $10 has been paid in, payable Aug. 15. By this action of the directors the company is formally dissolved. As the par value of the stock was $10 per share, the dividend is one of 25 cents on the dollar. The total amount of the dividend will be about $562,000. The number of shares outstanding was 225,120. If all had been paid for in full the dividend would be $562,800.

TELEPHONY IN CHICAGO.—It is announced that A. G. Wheeler, president of the Illinois Telephone & Telegraph Company, has arranged for a loan of $5,000,000 to carry on the work of completing the company's plans in this city. The loan is to be secured by an issue of 5 per cent 30-year gold bonds. The $5,000,000 stock of the company is to be trusteed and the money borrowed is to be paid over only on vouchers for construction work done.

ROCHESTER TO NIAGARA.—A mortgage has been executed at Rochester, N. Y., by the Buffalo, Niagara Falls & Rochester Railway Company for $3,500,000, covering the entire assets of the road, to Sutro Brothers, of New York City. The funds secured by the mortgage will be used to build the road, work on which will be started immediately.

NEW ENGLAND TELEPHONE.—Although the subscription books for the new stock of the New England (Bell) Telephone & Telegraph Company will not close until July 27, subscriptions are coming in very satisfactorily, and there is every reason to believe that the entire issue of $2,577,000 will be taken almost entirely by present stockholders. The company proposes to use the proceeds of this new stock for the payment of outstanding obligations, amounting all told to about $1,000,000, which have accumulated, but which have never been capitalized, and the balance will be required for general construction work to the amount of something over $1,000,000 during the coming year. Plans for new construction work at present on hand contemplate nothing of special importance beyond additions to the plant necessary to meet the requirements of a business that is growing at the rate of 15,000 subscribers per annum.

GENERAL CARRIAGE COMPANY'S AFFAIRS.—Announcement is made that a committee will be named soon to reorganize the affairs of the General Carriage Company. That corporation started business three years ago, having a valuable franchise to operate electric vehicles in New York City. The company bought, for a large sum, the old Sixth Avenue car stables, at Forty-third and Forty-fourth Streets, taking out a heavy mortgage. Not long ago it relinquished all right to the property. Shares of the General Carriage Company were once active and strong on the "curb," where they sold above 20. The stock is now about 1½. It is understood that the plan of reorganization proposes placing the capital of the company on a basis more favorable to shareholders.

CONSOLIDATION IN ST. LOUIS.—Our St. Louis correspondent states that the consolidation of the Laclede Gas Light Company and the Imperial Heat, Light & Power Company, of that city, is contemplated by a deal that is progressing in New York. The terms are such that all the electric and gas lighting corporations in the city may enter it, providing they do not put too high a valuation on their stock.

ACHESON GRAPHITE.—The International Acheson Graphite Company has declared a 3½ per cent dividend on the preferred stock, for the half year, payable Aug. 1. Its present year's business will approximate 1,000,000 lbs. in graphite anodes and electrodes alone, while the consumption of pure graphites for paints, stove polish and other purposes is showing rapid strides.

Commercial Intelligence.

THE WEEK IN TRADE.—The industrial conditions during the past week were affected somewhat by heat, drought and strikes, but notwithstanding these influences a fair volume of business was reported and the situation generally is accepted calmly and cheerfully. The crop conditions are more favorable than they were at the time of the last report. The great steel strike, closely followed by the tie-up of hard coal mines by a few mine firemen, has resulted in the greatest apparent suspension of labor reported for some years past. It is estimated, however, that the actual number on strike in the steel trade is less than 50,000, and the number of idle coal miners is not half this amount. The iron and steel trade is unsettled by the strike. The usual summer shut-down, which increases the number of those idle from other causes, has led to some apparent overestimates of the number of men on strike. The outlook is, with the continuance of the strike, for some weakness in the cruder forms of iron, which will tend to accumulate, and, on the other hand, induce some advance in the finished products affected by the strike. There are signs of disintegration in the machinists' strike, which is generally conceded to have been a failure. The business failures for the week as reported by *Bradstreet's*, were 208, as against 199 the previous week, and 202 of the same week last year. In the metal market, copper is still quoted at 17 cents for Lake and 16⅝ for electrolytic and casting. These quotations, however, are nominal, as there is no demand from home consumers nor from abroad.

MR. J. P. McDONALD, of the railroad contracting firm of J. P. McDonald & Co., whose New York offices are at 35 Nassau Street, has just returned from a four-months' trip to Ecuador. He gives us some interesting information on the possibilities of that country for the sale of electrical plants, etc. Mr. McDonald's firm is now engaged in the construction of the Guayaquil & Quito Railway on behalf of the Ecuadorian Association, Limited, whose New York address is 33 Wall Street. Mr. McDonald says that there are several projects for electric lighting and power schemes only waiting completion of the railroad, when he feels assured they will be put through immediately. "In fact," he said, "I know of three or four instances where the necessary capital has already been fully subscribed, and if only railroad transportation facilities would permit of the machinery being brought up to the highlands where the most prosperous towns are located, the contracts would be given out right away. The flourishing town of Rio Bamba, which has a population of some 25,000, is one of the several places desirous of installing an electrical plant. In the mining, flour milling and sugar refining equipments, which will shortly be an accomplished fact in Ecuador, electrical machinery will also play an important part. The railroad is now being rapidly pushed on to completion. We are already up on the plateau at an altitude of 11,000 ft. Shortly we shall have 30,000 men engaged in the construction of the road, and hope to have the entire 300 miles completed inside of 12 months, when one of the richest countries in the world will be opened up to American trade and enterprise."

THE S. MORGAN SMITH COMPANY, York, Pa., has lately supplied the Floriston Pulp & Paper Company, Floriston, Calif., with horizontal shaft McCormick turbines, operating under 50-ft. head, developing 6000 horse-power, which are used for driving machinery in its pulp and paper mill. The Walla Walla Gas & Electric Company has a single 27-inch McCormick turbine, which will operate an electric plant under 90-ft. head; the Boston & Montana Consolidated Copper & Silver Mining Company, Great Falls, Mont., a pair of horizontal shaft, 54-inch McCormick turbines, developing 2800 horse-power; the Washington Water Power Company, Spokane, two pairs of McCormick turbines in iron cases on horizontal shaft, each pair developing 1800 horse-power under 74-ft. head; Oregon City Manufacturing Company, Oregon City, pair of 36-inch in iron case on horizontal shaft; the Wilamette Pulp & Paper Company, pair of 36-inch, mounted in a similar manner; Crown Paper Company, of same place, six horizontal shaft McCormick turbines in iron cases. The Missouri River Power Company, Helena, Mont., is at present installing six sets of horizontal shaft McCormick turbines of 1100-hp capacity, which are being direct connected to generators.

CITY OF MEXICO TRACTION.—It was reported this week that control of the electric traction system in the City of Mexico is to pass into the hands of American capitalists. At present the system is operated by British capital, Wernher Beit & Co., of London, being virtually the controlling factors in the enterprise. Mr. A. E. Worswick, the resident engineer, is now on his way to Europe for the purpose of attending the annual meeting of the company, which will be held this week in the British metropolis. It is expected that at this meeting some important statements will be made relatively to the future control of the company. It is stated that when the projected deal goes through, the lines will be considerably extended, with the result that American manufacturers of electrical equipment and other machinery will benefit substantially by the receipt of further contracts.

THE KRAWJEWSKI-PESANT COMPANY, whose New York offices are located in the Hudson Building, 32 Broadway, has awarded a contract to the Worthington arm of the International Pump Company, calling for the pumping equipment to be installed in the sugar plant of the Santo Filomena, Matanzas, Cuba. The contract, which is valued at nearly $7,000, will include a 12 by 22 by 18 injection pump; one 7½ by 8½ by 10 sweet water pump, also one 10 by 7 by 6 juice syrup equipment. The Krawjewski-Pesant people have also placed an order with the Stillwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, through its New York office in the Washington Life Building, 141 Broadway, for two 24 by 24 filter presses, together with one 4½ by 3 by 4 Smith-Vaile pump, which will be utilized for scum purposes. This equipment has been requisitioned by the Succesarres de Tomas de la Torre for installation in the sugar factory of the Hacienda San Carlo, Mexico.

THE KEYSTONE ELECTRICAL INSTRUMENT COMPANY, of Philadelphia, reports a steadily increasing export trade for its specialties, particularly with Great Britain, France, Spain, Japan and South America. The Philippines are looked upon by the Keystone Company as one of the coming markets for electrical instruments, etc. The Barcelona, Spain, Tramways Company has requisitioned for a number of Keystone switchboard instruments. President Stevens said last week to a representative of ELECTRICAL WORLD AND ENGINEER that the Philadelphia plant of the company was about to be trebled in capacity, and that contracts for the necessary equipment, etc., would be determined on within the present month.

MR. W. B. ROMMEL, chief constructing engineer and general manager of the Lisbon (Portugal) Tramways, according to advices just received by local parties, will leave Europe for the United States within the next week or ten days. It is expected that he will place some further substantial contracts for equipment, etc. Close on $1,000,000 has been already placed directly or indirectly with American manufacturers for material, etc., for the Lisbon traction system, which will be the first electric road in that part of the world. The system is controlled by the Portuguese Development Company, of Bishopsgate Street Within, London, E. C., which concern has been largely financed by the well-known Anglo-African financial house of Wernher Beit & Co.

THE MORRIS ELECTRIC COMPANY, of New York City, report receipt of a $20,000 contract for weather-proof cable, 400,000 and 500,000 cm, which is to be utilized on the Mexican Tramway system, City of Mexico.

EXPORTS OF ELECTRICAL MATERIAL.—The following are the exports of electrical material from the port of New York for the week ended July 19: Antwerp—13 cases electrical material, $986; 3 packages electrical machinery, $11,250. Argentine Republic—160 packages electrical material, $8,998. Bristol—1 package electrical machinery, $1,100. British West Indies—173 packages electrical material, $2,588. Berlin—7 packages electrical material, $188. British Australia—2 packages electrical, $14; 21 packages electrical machinery, $10,780. Barcelona—2 cases electrical material, $250. Brazil—28 packages electrical material, $1,413; 32 packages electrical machinery, $4,184. British Possessions in Africa—84 packages electrical machinery, $7,350; 6 packages electrical material, $127. Charente—22 packages electrical material, $374. Cuba—39 packages electrical material, $851. Central America—1 package electrical material, $119. Glasgow—9 packages electrical material, $338. Genoa —2 packages electrical material, $77. Hamburg—19 packages electrical material, $718. Havre—21 packages electrical material, $2,687; 10 cases electrical machinery, $340. London—125 packages electrical material, $4,825. Liverpool—77 packages electrical material, $7,052; 37 packages electrical material, $2,016. Milan—56 packages electrical material, $1,431. Mexico—2 cases electrical machinery, $468; 170 packages electrical material, $931; 2 cases telephone material, $102. Nova Scotia—27 packages electrical material, $246. Newfoundland —12 packages electrical material, $223. Newcastle—5 packages electrical machinery, $1,100. Peru—21 cases electrical material, $575. Reval—3 cases motors and parts, $2,478. San Domingo—13 packages electrical material, $86. St. Petersburg—7 packages electrical material, $251; 1 package electrical machinery, $400. U. S. Colombia—21 packages electrical material, $752. Venezuela—46 packages electrical material, $1,237.

SALES OF APPARATUS.—The Gregory Electric Company, Chicago, reports among recent sales: A 120-kw Siemens & Halske direct-connected generator, to the Kewanee, Ill., Electric Light Company; one 150-kw Siemens & Halske direct-connected generator, to the Chicago Bridge & Iron Works; one 150-kw Walker generator, to J. A. Powers, Glens Falls, N. Y.; one 150-kw Thompson-Ryan, 250-volt generator, to the Potomac Electric Company, Washington, D. C.; one 70-kw General Electric, to the Mattoon, Ill., Heat, Light & Power Company; one 120-kw General Electric, three-phase alternator, to the Muncie, Ind., Electric Light Company; one 75-kw, 60-cycle Westinghouse alternator, to the McConnelsville-Malta, Ohio, Electric Company; one 70-kw Warren alternator, to the Robinson, Ill., Electric Light Company; one 100-kw, 500-volt Edison generator, to the Chattanooga Railway Company; one 60-kw General Electric alternator, to the city of Cumberland; one 35-kw General Electric, to Globe, Ariz., Electric Company; one 35-kw Thomson-Houston alternator, to the Placerville, Calif., Electric Light Company. In addition to these it reports sales of several thousand horse-power of small second-hand alternators, generators and motors.

ELECTRIC LAUNCHES IN CHICAGO.—Sunday, July 13, the remaining World's Fair electric launches of 1893 were put in commission at Jackson Park, Chicago, making a fleet of five launches. The Haschke system was adopted. All the batteries in these launches (600 cells of 150 ampere-hour capacity), are now in first-class condition. The old positive plates were all thrown out and the Haschke plates substituted, which made a reduction in weight, it is said, of 25 per cent, and also an increase in mileage capacity. Eleven hundred and forty passengers were carried. The launches have a seating capacity of 25 persons each, and travel at the rate of 6 and 8 miles per hour, respectively. In the near future the South Park Commissioners contemplate to connect the lagoons of Jackson Park with the lagoons of Washington Park by way of the old Midway, and operate about 10 more electric launches.

STORAGE BATTERY CONTRACTS.—At the present time Sipe & Sigler, of Cleveland, O., manufacturers of the Willard battery, have under way 12 large plants for street railway, central stations, isolated lighting plants and Government coast defense work. The latest contract is for a storage battery for the Cleveland Electric Railway Company, which will probably be the largest battery in street railroad service in the world. This battery will consist of 282 cells of 4000 ampere-hours capacity, and will weigh nearly 500 tons when completed. The Cleveland Electric Railway Company, for whom this battery is to be installed, owns and controls more than 200 miles of track. It recently installed in one of its branches two Willard batteries, and to the satisfactory operation of the same is largely due the new installation.

NATIONAL CABLE & WIRE COMPANY.—It is stated that the National Cable & Wire Company, Pittsburg, has purchased from the American Sheet Steel Company the latter's plant at Shousetown, for $30,000. The purchase includes all the machinery and buildings of the plant and 16 acres of land. The purchasing company will erect several new buildings. It will engage in the manufacture of telephone and telegraph cables. The wire will be drawn from the rod by patented machinery. David Carlin is president of the company; J. A. West vice-president, and John E. Powell secretary and treasurer. The directors, besides the above, are John H. Carlin, W. J. Brennen, J. W. Kelly and H. W. Klein.

WESTINGHOUSE BONUS SYSTEM.—A bonus system has been inaugurated by the Westinghouse Electric & Manufacturing Company at the plant in East Pittsburg. The bonus is based on the net earnings of the company, and is distributed among the assistant superintendents, general foremen, foremen and sub-foremen, the same to be paid quarterly in addition to their salaries. For the quarter ending June 30 the least amount received by any one man was $18, and the highest amount $50. It is stated that if the system is a success it will be extended by the company to take in the skilled workmen of the plant.

COPPER EXPORTS.—The half-yearly copper statistics of production and exports show a slight falling off in the domestic output, a drop of 44 per cent in exports and a gain of 9 per cent in the production of European mines. During the first six months of 1901 the United States shipped abroad only 50,027 tons of copper against 50,227 tons during the first half of 1900. Europe has pushed her output to an unusual extent during the last three months, showing for the first half year a production of 46,847 tons, against 43,153 for the same period in 1900.

POWER FOR ATLANTA.—S. Morgan Smith Company, the turbine and power transmission machinery builders, of York, Pa., inform us that they are interested in the Chattahoochie River, owning all the water-power rights for the development of the Bull Sluice property. It is their intention, in conjunction with others, to develop this power at once, and to distribute it in Atlanta, Ga., for manufacturing purposes. Work has already begun, and when completed the plant will be able to deliver 10,000 ehp. in Atlanta.

THE NEW PROCESS RAW HIDE COMPANY, Syracuse, N. Y., is in receipt of an order from an Eastern machine company for 10-pair of gear wheels, the larger to be cut cast iron and the smaller New Process raw hide, making a noiseless combination. The cut cast iron gears run from 20 inches to 80 inches, and the raw hide pinions from 6¾ inches to 16 inches in diameter.

QUINCY COPPER MINING.—It is stated that the engineers of the well-known Quincy Mining Company will shortly introduce a system of electric tramming. Whereas it now takes two men to push a single car of copper ore to the shaft opening, electricity will hereafter send four cars in one train to the shaft opening, the entire four cars being in charge of but one man. The cost of tramming will be reduced at least 25 per cent under the new arrangement.

BALL ENGINE ORDERS.—The State lunatic asylum at Austin, Texas, is being equipped with electricity. Two engines built by the Ball Engine Company, Erie, Pa., one of 125 horse-power, the other of 60 horse-power, direct connected to Westinghouse generators, furnish the power. The Bush Building, Chicago, Ill., is installing an electric plant consisting of two 100-hp engines, built by the Ball Engine Company, direct connected to Northern generators.

MATERIAL WANTED.—The Meridian, Miss., Light & Railway Company, Mr. R. Laurie Ellis, superintendent, will shortly make a number of improvements in their system, and will be in the market for material for switchboard work, overhead trolley construction and light lines. Mr. J. H. Wilson is president; Mr. W. H. Armbrecht, vice-president, and Mr. John Kamper, secretary and treasurer. The company will be glad to hear promptly from interested parties.

NOISELESS PINION FOR GLASGOW EXHIBITION.—A "New Process" noiseless pinion and cut cast iron mate have recently been shipped to Glasgow, Scotland, by the New Process Raw Hide Company, Syracuse, N. Y. They are to be used in connecting an electric motor to a Babcock printing press in use at the Glasgow Exhibition.

ELECTRIC RAILWAY CONTRACT IN MADRID.—Tenders are invited until July 30 by the Minister of Agriculture, Industry, Commerce and Public Works, at Madrid, for the building of an electric railway from Cadiz to San Fernando with a branch to La Carraca. A provisional deposit of 18,118 pesetas, or about $3,486, is required to qualify any tender.

JESSOP STEEL.—One of the standard commodities the world over is Jessop steel. A dispatch from Sheffield, England, of July 15, says: The shareholders of William Jessop & Sons, Limited, steel manufacturers, at a meeting to-day approved a scheme for the establishment of steel works at Washington, Pa., and the formation of a subsidiary company under the laws of Pennsylvania.

M. PEDRO MARTINO, of the export sales department of Babcock & Wilcox Company, of New York City, has left for South America for the purpose of opening offices at Lima, Peru. M. Martino, according to present arrangements, will remain as manager of the new agency.

General News.

THE TELEPHONE.

CHARLESTON, ARK.—The Franklin County Telephone Company has been incorporated here with a capital stock of $50,000.

CAMDEN, ARK.—A telephone line from Camden to Woodberry, Calhoun County, is now under construction. Mr. W. F. McKnight, of Woodberry, is the promoter and builder of the line.

SAN FRANCISCO, CALIF.—The Wireless Telephone & Telegraph Company, capitalized for $5,000,000, has been incorporated. The incorporators are A. S. New and S. J. Donleavy.

SAN FRANCISCO, CALIF.—The San Francisco Board of Supervisors has requested the City Attorney to inform that body whether or not the People's Mutual Telephone Company has forfeited its franchise and is liable under its bond. The company failed to begin operations before the expiration of the time named in its permit.

SAN FRANCISCO, CALIF.—The Pacific States Telephone & Telegraph Company has erected a new brick shop building of large dimensions on Natoma Street, and 150 men and boys will be employed there. The company intends to proceed very shortly with the construction of a six-story brick building, adjoining the shop, and when completed it will be occupied by the general offices and store rooms. That will leave the large building at 216 Bush Street to be devoted to the main telephone exchange and other offices.

LOVEJOY, GA.—The Clipper Construction Company, C. M. Curtis, business manager, has been granted a franchise to put up a telephone line from Atlanta to the county line. This company makes a specialty of rural telephones, and it is said that it proposes to have lines from Jonesboro, Lithonia, College Park and other points in the vicinity of Atlanta. The system will connect with the Standard system in Atlanta.

MAGNOLIA, ILL.—The Magnolia Mutual Telephone Company, of Magnolia, capital stock $2,500, has been incorporated by Perry Dakin, E. E. Barbour and John Davidson.

VENICE, ILL.—The Kinloch Telephone Company will try to secure a franchise at the next meeting of the County Board to make extensive additions to the lines in Madison County.

PLEASANT PLAINS, ILL.—The Boynton Telephone Company, Pleasant Plains, has been incorporated; capital stock, $2,500. Incorporators: E. D. Boynton, J. M. Howard and O. E. Perry.

CHARLESTON, ILL.—The Charleston Telephone Company is remodeling and rebuilding its plant, doubling its cable facilities and putting in an entire exchange equipment of the Sterling Electric Company's switchboards and protective devices.

CHICAGO, ILL.—An innovation on board a steamboat has been made on the steamer Virginia of the Goodrich Line. It consists of a telephone instrument in the main saloon which is connected with the system of the Chicago Telephone Company and will enable a passenger on the steamer before she leaves the dock to call up friends in any part of the city.

MATTOON, ILL.—The $75,000 fire at Mattoon, Ill., July 3, entirely destroyed the central office of the Mattoon Telephone Company, as well as considerable of aerial cable. Dr. Lumpkins, the president, has arranged with the Sterling Electric Company for a temporary apparatus so as to enable it to give service, and inside of sixty days will have built a new fireproof building and one of the most modern telephone buildings in the State of Illinois. Its entire equipment will be the well known make of the Sterling Electric Company.

WABASH, IND.—While a boy was flying his kite the wind carried the string across the wires of the telephone company and an electric wire, and the current of the latter was diverted into the telephone lines. Ninety telephones were burned out, while the operators at the exchanges were severely shocked. It will require several days to repair the damage.

INDIANAPOLIS, IND.—Charles M. Cole, of New York, general manager of the American Telegraph & Telephone Company, was before the Indiana State Board of Tax Commissioners last week, asking a reduction in the assessment of the company's 10,985 miles of wire and other property in this State. The company is assessed $25 per mile and Mr. Cole asks a reduction of $5 per mile.

CHERUBUSCO, IND.—Virgil A. Geiger, editor of the Cherubusco *Truth*, has the distinction of being the only publisher in Indiana who owns and operates a telephone system in connection with his newspaper. He claims it to be one of his most valuable auxiliaries because of the quick communication it affords with small towns and communities in the field covered by his newspaper.

INDIANAPOLIS, IND.—The Indiana State Board of Tax Commissioners is in session and the New Telephone Company, of this city, has taken an appeal to the Board from its assessment in this county. The appellant claims that the County Board of Review ignored the opinion of the Attorney General, and assessed parts of the property of the company, which, under the opinion, can be assessed only by the State Board of Tax Commissioners.

CRAWFORDSVILLE, IND.—One of the phenomenally successful independent plants is located at Crawfordsville, Ind. This is a town of about six thousand people. The company is five years old and at this time is adding new subscribers at the rate of one hundred a month. It now has a central office equipment for one thousand subscribers, and has placed its order for additional equipment. Its equipment was furnished by the Sterling Electric Company of Lafayette.

CONCORDIA, KAN.—The Concordia Telephone & Telegraph Company has been incorporated with a capital stock of $20,000.

TOWSON, LA.—Messrs. B. F. Jordan, W. M. Sterling, R. G. McCullough, J. P. Jordan and others have incorporated the Union Telephone Company; capital, $3,000.

BALTIMORE, MD.—The Union Telephone Company, of Baltimore County, has been incorporated by Benjamin F. Jordan, Wm. M. Stirling, Reuben G. McCullough, J. P. Jordan, Newton W. Hershey and James A. Gibson, of Maryland, and Joseph M. Anderson, of Pennsylvania. The company proposes to operate a telephone line from White Hall, Baltimore County, to Stewartstown, York County, Pa., and to any and all other points in Maryland and elsewhere. The capital stock is $3,000.

BALTIMORE, MD.—The war between the Bell and Maryland Telephone companies, in Maryland, is forcing both companies to cut rates to the lowest point and extend lines in every direction. The Union Telephone & Telegraph Company, which owns the Maryland Telephone Company, has been quietly extending its lines into Baltimore and Harford counties and into Pennsylvania. By acquiring existing lines, building new ones or securing contracts with other companies, it has brought into direct communication with Baltimore a large area. The company has bought the Creswell Company, the Baltimore & Harford Company, and effected a long term contract with the Highland Company, which enables it to cover every point of the northern counties to and beyond the Pennsylvania line. A branch from Darlington, in Harford County, crosses the Susquehanna River into Cecil County, at Conowingo, and continues to Delaware. Franchises have been secured for a long distance line between Baltimore and Wilmington, Del.

BOSTON, MASS.—The New England Telephone Company is soliciting subscriptions for telephones among bankers, brokers, banks and trust companies in Boston, for whom it intends to establish an exclusive exchange for quick service among subscribers thereto. Telephones connected with this exchange will be connected with no other. Over thirty subscribers already have been obtained, to whom the cost will be $72 a year each.

MEXICO.—A certificate of incorporation has been placed on file for the Mexican National Telephone Company, of Philadelphia, capital $1,000,000, to conduct and operate a telegraph and telephone system in the Republic of Mexico.

DETROIT, MICH.—The Valley Telephone Company, which recently bought a system in Huron County, is building two metallic lines to Bad Axe.

YPSILANTI, MICH.—The general indignation against the Michigan Telephone Company for its poor service, has culminated in three of the most important interests in this city, the First National Bank, the Ypsilanti Gas Company and the Peninsular Paper Company, refusing to pay the full amount of their telephone bill on the ground that poor service does not deserve pay.

HOUGHTON, MICH.—The Michigan Telephone Company announces that it will build a line connecting Houghton County with the Ontonagon County mines, and will purchase the Standard Brothers' system in that county if guaranteed $5,000 in long distance tolls.

VERNON CENTER, MINN.—The Farmers' Telephone Company is extending its line northward, through the villages of Vernon Center and Garden City.

CASSVILLE, MO.—The Barry County Telephone Company has been sold to Mr. J. W. Hill.

MONETT, MO.—The Southwest Missouri Telephone Company, of Monett has been incorporated with a capital stock of $50,000. The incorporators are Finley P. McGuire, A. Singer, R. H. Davis and others.

TRENTON, N. J.—The Standard Telephone & Telegraph Company, of Camden, N. J., has been incorporated; capital, $100,000. Incorporators: Frank R. Hansell, Wm. F. Eidell and John A. MacPeak.

CAMDEN, N. J.—A traffic arrangement has been effected between the Eastern Telephone & Telegraph Company, of Camden, and the Keystone Telephone Company, of Philadelphia, for an intercity connection. The arrangements are to go into effect on November 1. The work of laying the cable between Philadelphia and Camden will begin in a few days.

NEW YORK, N. Y.—The New York & New Jersey Telephone Company has instituted a contest in the Supreme Court over the assessment levied, for the purposes of State taxation, on its plant in the counties of Kings, Queens and Richmond.

NEW YORK, N. Y.—The stockholders of the Interstate Telephone Company met in Trenton N. J., on July 17 and ratified a proposition to increase the capital stock from $100,000 to $5,000,000 and issue $5,000,000 in bonds. A percentage of the money realized from the sale of the bonds will be used in construction work, while a considerable proportion of the stock will be used in paying for various companies acquired. The Interstate is one of the most important independent concerns in the country. It has acquired all the independent telephone companies in New Jersey except the system in Camden.

SPRINGFIELD, OHIO.—The City Council is unable to adjudicate the claims of three rival telephone corporations asking franchises.

MARYSVILLE, OHIO.—The Marysville Home Telephone Company is rebuilding its system, and connection will be made with North Lewisburg and Milford Center.

KENTON, OHIO.—The Kenton Telephone Company has increased its capital stock from $30,000 to $50,000 to provide for improvements. J. L. Moore is president and Horton Park, secretary.

COLUMBUS, OHIO.—The local management of the Central Union Telephone Company has voluntarily increased the salaries of all its operators about 20 per cent. and reduced the working day to nine hours. About 100 girls are concerned.

TOLEDO, OHIO.—F. W. Wachter, of Toledo, is engineering a deal to connect with cables all the larger islands in Lake Erie, giving independent telephone service. This would be of great advantage to the residents of the islands as they are entirely isolated in winter.

CINCINNATI, OHIO.—The extending use of the telephone among the farmers is illustrated in the remarkable popularity enjoyed by the co-operative exchange which connects forty townships in Montgomery County, Indiana. There are over six thousand telephones in use in this territory alone among the farmers.

CINCINNATI, OHIO.—It is now said that a large and wealthy syndicate has

discovered the existence of a franchise under which an independent company may get a foothold in this city. A number of attempts in this direction have ended disastrously. It is said that the new company has been working quietly but effectively for several weeks and will soon be ready to enter the field.

CLEVELAND, OHIO.—The committee appointed by the Ohio Telephone Association at its meeting in June to confer with the State Board of Appraisers for the purpose of making suggestions as to a uniform and equitable method of taxing the instruments of the Independent companies, met with the board at Columbus last week. The committee is composed of Edward Kibler, of Newark; H. M. Daugherty and Frank A. Davis, of Columbus; H. D. Critchfield, Cleveland, and D. J. Cable, of Lima. The committee presented some interesting statements, which the board promised to consider, and the session was adjourned for a week.

CLEVELAND, OHIO.—The stockholders of the Consolidated Telephone Company and the Inter-Ocean Telephone Company, whose incorporation and plans were referred to in a recent issue, met in Cleveland and organized. The officials of both companies are the same, the directors being the following: W. H. Price, R. M. Parmely, J. H. Fuller, Luther Allen, C. H. Stewart, E. G. Tillotson, H. D. Critchfield, K. F. Gill, John Sherwin and Burt G. Hubbell. Officers were chosen as follows: B. G. Hubbell, president; W. H. Price, first vice-president; R. M. Parmely, second vice-president, and J. H. Fuller, treasurer. The company now has at least 500 men at work building lines across the State and about 100 miles are already in operation. One of the first steps will be to connect with the lines of the United States Telephone Company at Erie, Pa., thus giving through long-distance connection for the systems of Illinois, Indiana, Michigan and Ohio. The headquarters of both of the New York companies will be in Cleveland.

PHILADELPHIA, PA.—The Northern Pennsylvania Telephone Company, of Wellsboro, has been incorporated, with a capital stock of $12,500.

ERIE, PA.—The stockholders of the Mutual Telephone Company will meet shortly for the purpose of taking action on a proposition to increase the bonded indebtedness of the company from $50,000 to $75,000. The company is constantly enlarging its business to accommodate the public.

KNOXVILLE, TENN.—F. B. Garrett, civil engineer of the Cumberland Telephone Company, has completed his surveys in East Tennessee. The construction of 100 miles of line between Jellico and Somerset, giving the eastern part of the State through connection with Kentucky will be started at once, making a complete system connecting Eastern Kentucky with all of the South.

ALVIN, TEX.—The Texas Construction Company, of San Antonio, will construct an independent telephone line between Houston and Galveston. This company will also establish an office in this city. The Alvin and Angleton Telephone Company will put in a local exchange here just as soon as arrangements can be perfected.

RICHMOND, VA.—The Richmond Telephone Company will install new switchboards and instruments and otherwise improve its service.

STAUNTON, VA.—The Long Distance Telephone Company of Virginia will increase its capital stock to $100,000 for the purpose of extending its lines.

TACOMA, WASH.—The Sunset Telephone Company will occupy its new three-story brick and stone building early in August. The new headquarters are equipped with all recent appliances in telephony, and 75 people will be employed in carrying on the work of the Tacoma exchange.

ELECTRIC LIGHT AND POWER.

SAN FRANCISCO, CALIF.—The Keswick Electric Power Company, which is installing a water-power electric transmission plant on Mill Seat Creek, near Shingletown, Calif., recently purchased the plants of the Redding Electric Light & Power Company and the Redding Water Company. Francis Smith, of San Francisco, was president of the companies operating in Redding.

SAN FRANCISCO, CALIF.—The California Power Company, which has its offices in Redlands, Calif., but will remove them to Los Angeles this fall, is purchasing machinery for its Bakersfield-Los Angeles electric power transmission line. The generating station will be located on the Kern River, near Bakersfield, just above the Power Development Company's power station. It is said that the new plant will have sufficient capacity to transmit 15,000 kilowatts to Los Angeles. Among the stockholders of the company are H. H. Sinclair, president and manager; F. C. Finkle, chief engineer; J. S. Cravens, of Pasadena; W. S. Tevis, of San Francisco; C. N. Beal, of Bakersfield, and G. B. Ellis, of Redlands.

SAN FRANCISCO, CALIF.—The Standard Electric Distributing Company recently obtained from the San Francisco Board of Supervisors a permit for the erection of poles, for electric lighting only, within the city limits. The poles will be of sawed redwood and painted. The pole line will extend from the boundary line between San Francisco and San Mateo counties. It is understood that the Distributing Company will handle the current transmitted to San Francisco by the Standard Electric Company, via its Blue Lakes transmission line, which is already constructed from Amador County to Redwood City, leaving but 30 miles to be completed. Several large electric power contracts were made some time ago by the Standard Electric Company in Oakland and San Francisco.

CARTERSVILLE, GA.—The Cartersville Light & Power Company has filed a bill to restrain the city from going contrary to a contract made in 1888 with the Orient Illuminating Company, of Maine, for the right to provide light, heat, etc., which company later failed and passed into other hands.

MONTICELLO, GA.—Mr. Bonner Jordan is removing his direct current dynamo and installing a low frequency alternator instead, adding ten new arc lamps and seventy-five or eighty incandescents for street illumination. The new system will be managed by E. S. Broddus, who had the direct current plant in charge. Steam power will be used.

CHICAGO, ILL.—The Quincy Steam Heat & Light Company, of Quincy, has been incorporated; capital stock, $150,000. Incorporators: J. C. Hubinger, J. W. Geltz and William West.

JEFFERSONVILLE, IND.—A receiver has been appointed for the Jeffersonville Electric Light & Water Company. The bonds of the company are owned in Pittsburg. The plant was built with the intention of selling it to the city.

BLOOMINGTON, IND.—Suit has been brought demanding that the City Council rescind the franchise granted to the Chicago Heating & Lighting Company. The charge is made that $1,000 was appropriated by the company to influence the Council and the newspapers to secure the passage of the franchises, and further, that the company has not carried out its part of the contract. The suit and charge has created a sensation and the people insist on a vigorous investigation.

INDIANAPOLIS, IND.—Judge Carter, of the Superior Court, has granted a temporary restraining order forbidding the reception of bids for electric lighting for this city on the specifications recently put forth by the Board of Public Works. The Court held that the specifications were drawn in such a way as to make a case of discrimination in favor of the Home Heating & Lighting Company and against the plaintiff, the Indianapolis Light & Power Company. The specifications are so palpably unfair as to occasion the Court to say that unless made fair to all bidders the injunction would be made permanent.

JEFFERSONVILLE, KY.—The Jeffersonville Light & Water Company has gone into the hands of a receiver, John J. Walsh having been named.

ST. LOUIS, MICH.—At the special election for bonding the city to complete the new water works and electric lighting plant, 28 negatives were cast out of some 400 votes.

LANSING, MICH.—The Thornapple Electric Company, of Hastings, capitalized at $100,000, has filed articles of incorporation with the Secretary of State. It is understood the new company expects to avail itself of a water-power in Thornapple River.

STARKVILLE, MISS., has voted in favor of issuing bonds for $10,000 to provide for an electric lighting plant.

ST. LOUIS, MO.—The Board of Public Improvements has adopted the draft of an ordinance authorizing that body to grant permission to any electric light or power company or any telephone company to build conduits in that territory outside the underground limits. Its introduction was occasioned by the application for a permit to build such conduits, on the part of the Citizens' Electric Light & Power Company in that district, outside the fire territory. The passage of the bill will give the company power to construct its lines without the necessity of securing the passage of an ordinance.

TECUMSEH, NEB., is to refund its $4,400 of electric light bonds, and new bonds will draw 4½ per cent., and be issued for a term of 20 years.

NEWARK, N. J.—The National Electric Light, Heat & Power Company, capitalized at $200,000, has been incorporated here by John E. Helm and Frederick C. Fischer, of Newark, and William Pelzer, of New York City.

EAST ORANGE, N. J.—Articles incorporating the Tuolumne Power & Development Company have been recorded in the office of the County Clerk. The object of the concern is to manufacture, buy and sell and distribute electric current for light, heat and power. The company is capitalized at $250,000. The incorporators are Edward B. Hawkins, Alfred G. Brown and Herbert S. Murphy. The New Jersey Registration & Trust Company will act as legal agent.

NEW YORK, N. Y.—The United States Power Company has been incorporated in New Jersey with a capital stock of $250,000. Its charter permits it to manufacture engines, etc. The incorporators are J. Wesley Allison, Kenneth K. McLaren and William M. Maloy, Jersey City, N. J.

SANDUSKY, OHIO.—The City Council has closed a contract with the Sandusky Gas & Electric Company for lights at $77.50 on a ten-year basis.

MORROW, OHIO.—The People's Electric Company has been incorporated by M. D. Conden, D. V. Sutphen, E. G. Wilson, E. C. Dunham and A. D. Hanley.

CINCINNATI, OHIO.—There was but one bidder for the contract of lighting the city of Cincinnati, the Cincinnati Gas & Electric Company. The price is $60 per lamp per year in the overhead wire district, and $72 per year in the underground district.

OTTAWA, ONT.—Work on the new No. 2 power-house of the Ottawa Electric Company is rapidly being prosecuted, and it is expected that the building will be completed and ready for the machinery about September 1 next. The machinery will be ordered from the Westinghouse Company, of Pittsburg, Pa. Three derricks and two hoists are in operation, and all the plant is being operated by electric power.

OTTAWA, ONT.—The agreement between the City of Ottawa and the new Consumers' Electric Company has been completed, and the company has deposited $5,000 with the city treasurer as a guarantee. One of the conditions of the agreement is that the company shall be in a position to supply lights to the extent of not less than 10,000 lamps within a year, otherwise the deposit will be forfeited to the city and the company's franchise will lapse.

HUMBOLDT, TENN.—The vote for the issuance of $30,000 in bonds for the extension and improvement of the water and electric light plant resulted in a majority of 74 favoring the bonds.

WOODSTOCK, VA.—The contract for erecting an electric light system has been let to the General Electric Company of Baltimore by the Woodstock Electric Light Company. Ten arc and forty incandescent street lights are provided for; also wires for 1200 incandescent lights and 2 65-hp gas engines.

GRAND RAPIDS, WIS.—The Electric & Water Company, of this city, will double its present capacity in order to furnish power to numerous small manufacturers that are desirous of going into business here.

THE ELECTRIC RAILWAY.

VANCOUVER, B. C.—The British Columbia Electric Railway Company, of Vancouver, will spend $100,000 for improvements to its system in the city of Vancouver. The company will build a large warehouse in the city at a cost of $20,000, will lay a new double track at a cost of $30,000, and will build a line to the Gorge, a distance of three miles, at a cost of $35,000.

LOS ANGELES, CALIF.—The San Bernardino County Traction Company has been incorporated.

SAN JOSE, CALIF.—The Supervisors of Santa Clara County will on Aug. 6 next sell a franchise for an electric railway between San Jose and Gilroy, a petition for which had been filed by Geo. T. Dunlap.

OAKLAND, CALIF.—The Oakland Transit Company has filed a new mortgage for $3,000,000 to cover the bonded indebtedness of the consolidated street railway system. Of this amount $1,400,000 will be used for new improvements and reconstruction work. The entire system is now operated by electricity transmitted 140 miles from the Bay Counties Power Company's plant on the Yuba River.

HARTFORD, CONN.—The incorporators of the Willimantic Traction Company, which is financially backed by M. A. Cavanaugh, of Boston, have organized, and state that the construction of a trolley system in the principal streets of Willimantic will be undertaken immediately. The directors, in addition to Mr. Cavanaugh, are Peter H. Carr, of Taunton, Mass.; Walter H. Clark, of Hartford, and Mayor William D. Grant and W. A. Arnold, of Willimantic. Mayor Grant was chosen president, Mr. Arnold secretary and Thomas F. Cavanaugh, of Boston, treasurer.

SPRINGFIELD, ILL.—The Chicago & Joliet Electric Railway Company, of Joliet, has increased its capital stock from $605,000 to $2,300,000.

SPRINGFIELD, ILL.—The Secretary of State has certified the incorporation of the Northern Illinois Electric Railway Company. Capital, $700,000.

SPRINGFIELD, ILL.—The Secretary of State has licensed the incorporation of the Olney, Lancaster & Mount Carmel Electric Railroad Company; principal offices at Mount Carmel; capital $50,000. The incorporators and first board of directors are Robert Parkinson and H. M. Mundy, of Mount Carmel; J. C. Couch, of Friendsville; C. J. Siebert, of Lancaster; J. J. Bunting, of Berryville, and Aden Knoph and William Bower, of Olney.

SPRINGFIELD, ILL.—Capitalists of this city and Louisville, Ky., will construct an electric railway from Springfield to St. Louis. Primarily the line is aimed to handle the St. Louis world's fair traffic from this city and intermediate points, although the road will be operated permanently for passenger, freight and United States mail business. A company has been incorporated and J. W. Gaulbert and St. John Bayle, of Louisville and F. W. Tracy and Edward W. Payne, of this city, will finance the project and place the bonds. The capital stock is $25,000.

DANVILLE, IND.—The Indianapolis, Danville & Western Traction Company has been incorporated.

PERU, IND.—The business men of this city have taken steps to build an electric railway to Gilead, in the northern part of this county.

MARION, IND.—The City Council has granted a franchise to the Cincinnati, Richmond & Muncie Electric road through the streets of this city.

VALPARAISO, IND.—The City Council has granted P. W. Clifford and C. W. Bartholomew, of this city, representing a Chicago syndicate, a franchise for an interurban car line in this city, which will connect with Chicago via Hammond and Whiting, and with Michigan City, Laporte and South Bend.

VALPARAISO, IND.—William Freeman, backed by a syndicate of Chicago capitalists, has been granted a franchise by the County Commissioners and the City Council to operate a street railway in this county. The object is to connect Laporte and Michigan City with the Hammond and Chicago electric line.

INDIANAPOLIS, IND.—The Muncie, Middletown & Greenfield Company has been incorporated. Capital, $100,000. The directors are headed by Wm. H. Wood. The Wabash Valley Railway Company, capitalized at $200,000, has also been incorporated. The road will be built with a view of carrying considerable grain freight. The principal office will be at Peru.

FORT WAYNE, IND.—Fort Wayne & Southwestern Traction Company has sold its Fort Wayne-Marion line to a syndicate composed of W. B. McKinley, of Illinois, Governor J. F. Hill, of Maine and other Eastern capitalists. The company will complete the construction of the line and will also build other roads out of Fort Wayne. A new company has been formed, with W. B. McKinley, of Illinois, president; S. L. Nelson, of Wichita, Kan., vice-president and manager, and W. B. McComber, of New Hampshire, as treasurer. The company will spend $3,000,000 in building and erecting lines in northern Indiana. The Fort Wayne & Southwestern will very likely be extended to Indianapolis.

HARTFORD, KY.—A scheme is on foot for the construction of an electric railway from Hartford to Beaver Dam, five miles distant. It is stated that sufficient capital has been secured to build the road.

NEW ORLEANS, LA.—The promoters of the electric railroad between New Orleans and Lake Pontchartrain have organized a company, with $350,000 capital stock, to promote the enterprise. A. H. Prentzel is president.

RUSSELL, MASS.—The Westfield Valley Electric Railway Association was formed here for the purpose of constructing a trolley line from Westfield to Chester, with branches to Blandford and Worthington.

DETROIT, MICH.—The consolidation of the Detroit & Toledo Short Line Electric Railway Company with the Everett-Moore syndicate has been concluded.

DETROIT, MICH.—The *News* says the consolidation of the Detroit & Toledo Short Line Electric Railway Company with the Everett-Moore syndicate has been concluded. Clarence A. Black, A. E. F. White, E. M. Fowler and J. M. Mulkey, who built and who have been operating the Detroit and Toledo line, have not parted with any of their stock. They all become by the consolidation joint owners, with Messrs. Everett and Moore, of all of the lines between Detroit and Toledo. The gap in the line from Detroit to Toledo, which is that portion of the route between Trenton and Monroe, will be built in a short time, and cars will be running between Detroit and Toledo over the electric route before many weeks.

CONCORD, N. H.—The Boston & Maine Railroad has bought control of the Concord, N. H., street railway.

ALBANY, N. Y.—The Oneonta, Cooperstown & Richfield Springs Electric Railway Company has received permission to increase its capital from $750,000 to $1,000,000.

ALBANY, N. Y.—All the Rochester corporations, the Buffalo Traction Company, the Buffalo Railway Company and the Crosstown Railway Company, of Buffalo, have agreed to pay the franchise tax as fixed by the Tax Commission, pending the decision in the New York Supreme Court.

UTICA, N. Y.—The Utica & Deerfield Railroad has been purchased by the Belt Line. The new owners will, for the present, operate the road as a horse car line. Eventually, it is expected, electricity will be substituted as the motive power and the tracks and rolling stock improved, or replaced by a new equipment.

ALBANY, N. Y.—At the meeting of the State Canal Board in Albany the Utica & Mohawk Railroad Company was granted an application to build a traction line between Utica and Mohawk, the permission of the Canal Board being necessary because the projected line is to run within ten rods of the Erie canal at three different stations.

ALBANY, N. Y.—The Saugerties & Palenville Railroad Company has been incorporated, with a capital of $250,000. The principal office of the company will be in Saugerties. The directors are R. N. Jackson and Chas. E. Jackson, of Middletown, Conn.; Eben Jackson, D. G. Gale and I. J. Lockwood, of New York City; D. G. Gale, Jr., and Martin Cantine, of Saugerties, and T. V. R. Brown and J. W. Searing, of Kingston.

MONTICELLO, N. Y.—The New York State Board of Railroad Commissioners has granted the application of the proposed Monticello, Fallsburgh & White Lake Railroad Company for authority to construct its road. The company will operate an electric surface line, sixteen and a half miles long, from the Fallsburgh station of the New York, Ontario & Western Railroad to Monticello, Sullivan County, and thence to White Lake.

NEW YORK, N. Y.—The Metropolitan Street Railway Company has ordered 200 new cars for the Broadway service, to be delivered before Oct. 1. About 250 more of the old cars will be fitted up for electric service, and will be in operation early in September. President Vreeland says that work on the proposed line along the Kingsbridge road from 166th Street and Amsterdam Avenue to Kingsbridge, will begin at once and that it will be finished within three months.

CINCINNATI, OHIO.—The Cincinnati & Eastern and the Suburban Traction Company will jointly use a power-house to be built at Coney Island, a suburban pleasure resort.

TOLEDO, OHIO.—The earnings of the Everett-Moore Syndicate of electric railways are given out to be $750,000 per month, and it is stated they will reach $1,000,000 for July.

CINCINNATI, OHIO.—The Cincinnati Traction Company will erect a modern building at the southeast corner of Fifth and Walnut in which to house all its executive departments.

OXFORD, OHIO.—The Cincinnati, Oxford & Western Railway, which is promoted by the Southern Ohio Traction Company, has applied for a franchise to enable it to build through Oxford.

WARREN, OHIO.—The Trumbull Electric Railway Company has applied to the City Council for a franchise through the western part of the town, to enable it to complete its new line to Leavittsburg.

CLEVELAND, OHIO.—The Northern Ohio Traction Company has made application to the County Commissioners for permission to double-track the Akron, Bedford & Cleveland line from Cleveland to Bedford.

LIMA, OHIO.—A franchise has been granted the Lima, Lewistown & Bellefontaine Electric Railroad Company to build a line from Lima to the Auglaize County line, along the south side of the Bellefontaine pike.

YOUNGSTOWN, OHIO.—The Youngstown & Sharon Railway & Light Company has authorized the issue of $500,000 worth of bonds for the construction of the Sharon & Newcastle Railway, work on which is already being pushed.

COLUMBUS, OHIO.—The Columbus, Newark & Eastern Traction Company, Columbus, has been incorporated with $10,000 capital stock, by R. H. York, H. J. Uhl, A. G. Collins, N. T. Horr and A. R. Horr, Cleveland capitalists.

TOLEDO, OHIO.—George Kerper, who recently secured control of the Toledo, Bowling Green & Southern Railway, has announced that the company will build an independent line into Toledo, paralleling the Toledo & Maumee Valley from Perrysburg to Toledo.

CINCINNATI, OHIO.—A local company, headed by Henry Leisure, of this city, will build an electric railway between Indianapolis and Danville, Ind. The company is incorporated as the Indianapolis, Danville & Western Traction Company.

CINCINNATI, OHIO.—General Manager Wagenhals, of the Millcreek Valley Street Railway Company, expects to have the entire line of the Hamilton, Glendale & Cincinnati Traction Company finished between Cincinnati and Hamilton by September 1.

TOLEDO, OHIO.—The Lakeside, Napoleon & Western Railway, now in process of construction, the Fremont Street Railway Company, and the Creager Electric Light plant at Fremont have all been purchased by Kerlin Brothers, of this city. The deal represents $100,000.

COLUMBUS, OHIO.—The Columbus Railway Company has voluntarily increased the wages of its employes. The new rate is 16½ cents for men in service three months, 17 cents for nine months men and 18 cents for men who have been in service one year or over.

CLEVELAND, OHIO.—The Cleveland, Elyria & Western Railway Company has cut down the running time on its line. Between Elyria and Cleveland the running time has been reduced to 1:30 from 1:45, and the running time to Wellington has been reduced about ten minutes.

CINCINNATI, OHIO.—Capitalists of this city will construct an electric railway between Stevens Point and Grand Rapids, Mich. The water power of the Valley will be utilized for power. S. P. Rogers, W. F. Young, J. C. Burton and A. Blanchard are among the Cincinnati capitalists.

CINCINNATI, OHIO.—The Cincinnati & Cleveland Railroad Company has petitioned the City Council of Franklin, Ohio, for a franchise through the streets of that place. From Franklin the line goes to Springboro, where it branches off to Dayton. A branch will be built to Lebanon.

COLUMBUS, OHIO.—The Marysville, Delaware & Mt. Vernon Railway Company has been incorporated by B. L. McElroy, of Mt. Vernon; James W. Holcomb, of Cleveland; S. D. Siddons, G. E. Miles and T. E. Simmons, of Columbus. The capital stock is $10,000, but will be increased to $1,000,000.

TOLEDO, OHIO.—The final deal for the transfer of the Toledo & Monroe Railway, which was owned by the Detroit & Toledo Short Line Railway Company, to the Everett-Moore syndicate, was effected recently. By the consolidation of the two roads, there will be a double track line from Detroit to Toledo, of which there are about fifteen miles uncompleted.

CLEVELAND, OHIO.—It is believed that the Toledo, Fremont & Norwalk Railway has passed into the hands of the Everett-Moore syndicate. The Cleveland people have needed this line to complete its system between Ohio and Michigan points. It is said that the price demanded for the road is not far from $3,350,000. It has a capital stock of $1,500,000, and is bonded for a like amount. It is stated that the new owners will make some extensive improvements to the line.

CLEVELAND, OHIO.—The Cleveland Electric Railway Company is making preparations to improve its service to take care of the increased traffic consequent with the G. A. R. encampment, to be held here the last of August. Work is to be started at once on a 2000-ampere storage battery plant adjoining the main power station to be used as an auxiliary. Work will also be started at once on the new loop which is to pass the union passenger station. The company is already figuring on placing contracts for 50 cars and another additional large unit for its power house to take care of next year's business.

CLEVELAND, OHIO.—By raising the tax valuation of the Cleveland City Railroad, popularly known as the Little Consolidated, from $600,000 to $6,233,000, Mr. Tom Johnson scored a victory in the campaign which he has been waging against the corporations since he was elected Mayor of Cleveland last spring. The president of the Little Consolidated is Senator M. A. Hanna. Recently the railroad company made its tax return placing the value of its taxable property at $600,000. The city annual Board of Equalization raised it to more than $6,000,000, or ten times the amount of the company's return.

OTTAWA, ONT.—The motormen and conductors, employed by the Ottawa Electric Railway Company, have come to an amicable agreement with the company in connection with their request for higher wages.

TORONTO, ONT.—A legal fight is imminent over the new assessment by the city of Toronto, Ont., of the electric street railway company's plant, that is, the rails, wires, poles and cars, exclusive of buildings and real estate. Last year the assessment under the "scrap iron" judgment of the courts, and not including the cars, which heretofore have been held to be personalty and therefore exempt, was $90,000. This year, in accordance with the act of the last session of the provincial legislature the whole plant, including cars, was assessed at $1,543,281, an increase of $1,453,281. The company has appealed to the Court of Revision.

PITTSBURG, PA.—The Pittsburg, McKeesport & Connellsville Railway Company is expending $400,000 in McKeesport in improvements.

SHARON, PA.—The Sharon-Newcastle Street Railway has authorized the issue of $500,000 bonds for the construction of a trolley line from Sharon to New Castle, a distance of 21 miles.

KITTANNING, PA.—A new electric railway from Graff to Rosston, this county, has just been surveyed. The officials of the Kittanning and Ford City Street Railway Company are interested in the new project.

PITTSBURG, PA.—Fourteen ordinances have been introduced in the Pittsburg Councils in connection with the new elevated and underground street railways. All the ordinances contain the provision that companies must pay 5 per cent. of net receipts annually to the city.

ALLENTOWN, PA.—At a meeting of the Lehigh Valley Traction Company last week Robert E. Wright, of Allentown, was chosen President, to succeed the late Albert L. Johnson. Loftin E. Johnson, son of Tom L. Johnson, was elected vice-president. W. H. Newbold, of Philadelphia, resigned as a director, and the vacancy was filled by the election of John Hoskins, of Philadelphia. C. M. Bates, of New York, formerly vice-president of the company, was elected secretary and treasurer. The vacancy in the directorate caused by the death of A. L. Johnson was filled by the selection of Loftin E. Johnson.

PITTSBURG, PA.—The great activity among local capitalists for the establishment of additional rapid transit facilities for this city, which has been going on for some time, culminated in the introduction of 13 ordinances in council last week requesting franchises for elevated and underground railways. All of these enterprises are controlled by Messrs. Oliver, Mellon and Bigelow. The latter have been connected with local street railways for a number of years. While for a long time it was considered that these rapid transit developments were merely political schemes, it appears now, however, that the promoters mean business, and it is expected that work on these new roads will begin as soon as the ordinances have finally passed by local councils.

CHATTANOOGA, TENN.—A movement is on foot to build an electric railway from Chattanooga to Nashville by an air line, to do a general freight and passenger business. It is proposed to utilize the power of the Caney Fork falls in operating this road, if it is built.

CHARLESTON, W. VA.—John A. Howard, of Wheeling, W. Va., and others expect to purchase the street railway in Charleston and may make improvements and extensions.

WHEELING, W. VA.—The Pennsylvania Railroad will allow the Ohio Rapid Transit Company to use its bridge over the Ohio to enter Wheeling, W. Va. The Pennsylvania is said to have used its influence in favor of the company in securing money to build and equip lines.

STEVENS POINT, WIS.—A franchise has been granted the Wisconsin Valley Lighting & Power Company to construct and operate an electric railway through the city.

FOND DU LAC, WIS.—C. D. Smith, in behalf of New York capitalists, has secured the right of way for a proposed interurban line from Fond du Lac to Oshkosh, a distance of about twenty miles.

THE AUTOMOBILE.

THE DAY AUTOMOBILE COMPANY has been incorporated in Kansas City, Mo., with a capital stock of $12,000.

HILLS vs. AUTOMOBILES.—Messrs. Miles T. Baird and Albert E. Aiken, who recently left San Francisco for the Yosemite Valley, had a successful trip from Stockton to Priest's Hill, but both automobiles were disabled in attempting to climb the hill.

NEW ENGLAND.—It is said that with the progress now being made in securing lighter and more efficient storage batteries, it is not unlikely that some new company will be formed to take over the present plant and equipment of the New England Vehicle Company.

NEWPORT PARADE.—Mr. William K. Vanderbilt, Jr., has suggested and may organize a novel parade on fête night at Newport, R. I. His idea is to have a procession of automobiles illuminated and decorated with brilliant electric light effects. There are 103 automobiles there at present, which by reason of their ability to carry electric batteries would be available to Mr. Vanderbilt's novel and sparkling turnout.

CHICAGO AUTOMOBILE RUN.—The Chicago Automobile Club members propose to wrest the world's record from Fournier early in September. Fournier's record was made on a run from Paris to Berlin, and so far is the leading automobile performance of the year. During the second week in September, however, the Chicago Automobile Club will make a journey to Buffalo, and the run is expected to be a race against time, with a view to taking the laurels from the Frenchman. H. M. Brinkerhoff, secretary of the club, is having a steam automobile built for the trip, which, it is stated, will develop fifty miles an hour on rough roads, and keep up an average of thirty miles without strain. Robert Shaw, who made the trip from New York to Chicago in an automobile recently, will be one of the party. It is doubted whether Fournier's speed can be equaled on American roads.

NEW INDUSTRIAL COMPANIES.

THOMAS A. EDISON, JR., CHEMICAL COMPANY has been incorporated in New York City under the laws of Delaware, with a capital of $400,000, to make and deal in chemicals.

THE WESTERN ELECTRIC & MACHINERY COMPANY was recently incorporated, with Los Angeles, Calif., as the place of business. Directors: W. B. Scott, Marion P. Waite, C. D. Wilbur, L. W. Waite and J. W. Johnson. Capital stock, $25,000; subscribed, $13,025.

THE AJAX MOTOR VEHICLE COMPANY, 32 Broadway, New York City, has organized with a cash capital of $10,000, to make high class electric automobiles. A. L. Simpson is president and general manager, and Walter Simpson, secretary and treasurer.

AMPERE ELECTRICAL MANUFACTURING COMPANY.—Messrs. Charles R. Whitehead, David A. Pringle, Robert E. T. Pringle, Francis H. Leonard, Jr., and Edward E. Cary, all of Montreal, Que., are seeking incorporation as "The Ampere Electric Manufacturing Company," with a capital of $50,000. The headquarters of the company will be in Montreal.

SUBMARINE SIGNAL COMPANY.—At Waterville, Me., on July 20, the Sub-Marine Signal Company was organized, with a capital of $1,000,000. The officers are: President, Henry M. Whitney, of the Dominion Coal Company; Treasurer, Arthur J. Mundy, of Boston; Directors, Henry M. Whitney, J. B. Millett, Arthur J. Mundy, Sir William Van Horne, President of the Canadian Pacific Railway; Heman W. Chalin, Harry Burnett, Thomas Allen, W. Cameron Forbes, and Henry M. Soule. It is understood that the company will introduce the system, recently described in these pages, on which Dr. Elisha Gray and Mr. Mundy worked together.

LEGAL.

"EDISON."—At Wilmington, Del., on July 15, at the instance of Thomas A. Edison, Judge Bradford handed down a decree in the United States Court enjoining the Edison Chemical Company from using the name, Thomas A. Edison or the term "Wizard" in connection with its business unless setting forth that Thomas A. Edison is not connected with the company or its business. The company is chartered in Delaware and has offices in New York.

PERU, IND.—Argument was heard during the week in the United States Court in the suit of the Central Union Telephone Company against this city. Three years ago the city authorities gave the company notice to take its telephone poles and wires off Broadway, and the company has failed to do so. The city authorities wish the poles planted through alleys, and the company contends that if it has to remove the poles from Broadway it will have to purchase private right of way in order to reach certain buildings with wires. It has a franchise which entitles it to use the streets and alleys, and the company

objects to being forced into buying private right of way. Judge Baker somewhat forestalled his decision by saying that it is of little moment to the city whether the company has to acquire right of way by purchase.

PERSONAL.

MR. N. THAYER has been elected a director of the American Bell Telephone and the American Telephone & Telegraph companies.

MR. L. D. BEYLARD has taken charge of the Philadelphia office of the National Conduit & Cable Company in the Real Estate Trust Building.

MR. H. BEVIS, of the General Electric Company, Limited, of England, is again a visitor to this country. His trips to the United States are becoming quite numerous.

MR. JULIUS JONSON has resigned the position of superintendent of the Starin shipyards and iron works, Port Richmond, Staten Island, and has established himself as a contracting and consulting engineer at 32 Broadway, New York City.

MR. W. C. HAWKINS, formerly with the General Electric Company, of Schenectady, N. Y., has been appointed general manager of the light and power departments of the Electric Light Company and the Cataract Power Company, of Hamilton, Ont.

MR. W. GRATZ, E. E., who has been connected editorially with the International Correspondence Schools, Scranton, Pa., has resigned to accept a position with Mr. Elmer G. Willyoung, New York, the manufacturer of electrical measuring instruments.

MR. J. L. GREATSINGER, the new president of the Brooklyn Rapid Transit, has had to exchange photographs with nearly 1000 men on the Duluth & Iron Range Railroad, from which he resigned recently. The pictures of his former staff and employees are reaching him in huge albums.

MR. GEORGE WESTINGHOUSE, JR., who recently returned from London, has again sailed for England on business connected with the British Westinghouse Electric Company, now becoming very prominent in English electrical work.

MR. T. A. EDISON visited the Pan-American last week, and was escorted around by Messrs. Luther Stieringer, "Fred." Ott, Mr. W. H. Markgraf, of the Edison Manufacturing Company, and Mr. W. Bee, of the Electric Vehicle Company. When he saw the effect at night, he remarked: "It is a wonder. As for the illumination, it is a record breaker." He left for Chautauqua, but is to return to the Show.

Trade Notes.

CHANGE OF NAME.—The name of the Acme Light, Heat & Power Company, Chicago, Ill., has been changed to Hot Blast Smokeless Stoker Company.

THE ELECTRIC APPLIANCE COMPANY, Chicago, is manufacturing the Eaco visual signal telephone switchboard, which it claims gives the same service as an electric light board, without its disadvantages.

THE UNION SWITCHBOARD COMPANY, Erie, Pa., has issued a pamphlet descriptive of the "Union Multiple Switchboard." Several of the illustrations are reproductions of photographs of a large switchboard of this type installed in an exchange.

JEANESVILLE PUMPS.—The Jeanesville Iron Works Company, Jeanesville, Pa., has issued two advance sheets, Nos. 13 and 14, describing and illustrating the company's centrally packed pumps and the Jeanesville economic pumping station of medium capacity.

THE IRON CITY ENGINEERING COMPANY, of Pittsburg, has been incorporated, with a capital of $25,000. Charles W. Ridinger is president, and Harry D. Hershey is secretary and treasurer. It succeeds Fessenden & Ridinger, contracting electrical engineers and manufacturers' agents.

THE CENTRAL ELECTRIC COMPANY, of Chicago, carries a large and complete stock of all types of the Edison-Lalande batteries, battery parts and renewals. This company is also offering to the public a new dry battery called "The Ideal," which in actual tests has given exceptionally good results.

NOISELESS PINION FOR GLASGOW EXHIBITION.—A New Process noiseless pinion and cut cast iron mate have recently been shipped to Glasgow, Scotland, by the New Process Raw Hide Company, Syracuse, N. Y. They are to be used in connecting an electric motor to a Babcock printing press in use at the Glasgow exhibition.

BATTERY MOTOR.—The Niagara Specialty Works, Manlius, N. Y., has issued a neat circular descriptive of the Niagara battery motor. The weight of this motor is only three lbs., and it is adapted for running a 6 or 8-inch fan either from a battery of from 4 to 10 volts, or from a 110-volt lighting circuit in series with several lamps.

THE STERLING ELECTRIC COMPANY is furnishing its well-known switchboards, protective devices and telephones for the following exchanges that are now in the course of construction: Bronson, Mich.; Stockwell, Ind.; Manson, Ind.; Kirkpatrick, Ind.; Alexis, Ill.; Toledo, Ill.; Tremont, Ill.; Goldsmith, Ind., and Clarks Hill, Ind.

TEMPERATURE REGULATION.—The Johnson system of electric temperature regulation is well described in a 32-page pamphlet issued by the Johnson Electric Service Company, of Minneapolis, Minn. As is well known, this system employs compressed air as the motive power for the operation of valves, in connection with electrical control.

ENGINE PACKING.—In a pamphlet entitled, "How to Pack Your Engines and Piston Rods," Mr. A. W. France, of Philadelphia, Pa., gives some practical information on this important subject. Mr. France manufactures metallic packings for every class of service. The pamphlet is fully illustrated with half-tone views and diagrams showing the methods of packing.

STORAGE BATTERIES.—We have received from Dr. Pfluger & Company, a pamphlet illustrating and describing the many forms of the Pfluger storage battery. Among the uses for which this battery is manufactured are for furnishing current to mechanical pianos, etc., for the operation of dental and medical apparatus and phonographs, for wireless telegraphy and for supplying current to hand lamps, etc.

Mr. J. P. BROWN, selling agent for the Weston Electrical Instrument Company, 136 Liberty Street, New York City, sends us a pocket price list of Weston instruments, which he has just issued. It embraces all the standard portable forms, and those for switchboard work, and will be found convenient for ready reference by those interested in such measuring apparatus. A copy will be gladly mailed to any address upon application.

SUBMERGED ELECTRIC MOTOR.—In an artistic catalogue the Submerged Electric Motor Company, of Menomonie, Wis., describes an electric launch propelling outfit, the main feature of which is a submerged electric motor. The motor is mounted on a shaft on the lower part of a rod which takes the place of the rudder and, of course, is enclosed in a water-tight case. The same company makes a storage battery for electric launches.

ELECTRICALLY DRIVEN TOOLS.—"Willey" electrically-driven tools form the subject of a 16-page catalogue issued by the James Clark, Jr., Company, of Louisville, Ky. Among the electrically-driven tools illustrated are a radial and a semi-radial drill, a shop saw, a tool and a center grinder. The various machine tools, aside from being electrically driven, have had improvements introduced made possible by this method of driving.

THE INTERNATIONAL CORRESPONDENCE SCHOOLS, Scranton, Pa., call attention to the fact that construction is given throughout the entire year, the vacations of the principals and instructors being arranged so that there is no interruption in the work of the schools. This affords an opportunity for mechanics and others who have a dull season during the summer to take up a course by mail and make good use of what would otherwise be waste time.

ELECTRIC SIGNALS.—Catalogue No. 3 of the American Signal Company, Baltimore, Md., entitled: "American Road Crossing Signals," has just been issued. In this system there is a contact arrangement installed 1500 to 2000 feet on either side of a road crossing. As the train passes this point the alarm at the crossing is operated and will continue to ring until the train has passed. Another means for operating the crossing signal is through the insulation of two rails of the track.

THE GREGORY ELECTRIC COMPANY, Chicago, reports business as particularly good, the capacity of its works being taxed to the utmost in filling orders. In addition to its regular monthly bargain sheet, this company now sends out a bi-weekly supplement of its transformers and meters, with net prices. This step was found necessary in order to keep its customers posted on this line, the stock in this department changing so often that a monthly list would not answer any longer.

THE STILLWELL-BIERCE & SMITH-VAILE COMPANY is now at work on quite an extensive water-wheel outfit for the Brownville Board Company, Brownville, N. Y. The job comprises four pairs of 33-inch improved cylinder gate Victor turbines, each pair mounted horizontally on a steel center discharge case, and working under 20 feet working head, to develop 400 horse-power. The wheels will set in an open stone flume. The job also includes draft tubes, wall plates for stuffing boxes, etc.

MARBLE TABLET BOARDS.—The Frank Adam Electric Company, 904 Pine Street, St. Louis, Mo., describes and illustrates in Bulletin No. 3002 its marble tablet boards, of which it makes a large variety. The list includes nearly one thousand different sizes and types of tablet boards, each one of which is different in detail. A discount sheet, dated July 1, is also being sent out to the trade. This company is the successor to the knife switch and switchboard department of the Emerson Electric Manufacturing Company.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, has recently issued a pocket-size net price list and discount sheet applying to its General Catalogue No. 22. This is one of the most complete price lists ever issued in the electrical business, covering, as it does, practically all the goods of standard make that pertain in any way to electricity. The book is bound in heavy linen covering, consisting of about 125 pages, and is of a size suitable for carrying in the pocket. It should prove of great use and convenience to any one wishing to always have with him prices that are right. The company is sending this book out to the trade, and it will be mailed on application.

LIGHT VS. ILLUMINATION.—In a pamphlet of 64 pages the Holophane Glass Company, New York, gives a great deal of information on the subject of light and illumination. The matter is very thoroughly discussed from a scientific standpoint, and developed in a way that gives the contents of the pamphlet great practical value. The use and misuse of high-power lights in general illumination is given careful consideration, and a chapter describes the evolution of prism glass as a means of utilizing light for illumination. The advantages of Holophane glass are discussed at length, and many illustrations are given showing the distribution of light by means of its use. The latter show to the eye at a glance how light is diffused or concentrated at different angles, according to the inclination of the prisms. In this connection it may be interesting to note that the Franklin Institute, Philadelphia, investigated the practical workings of Holophane globes, and awarded the John Scott Legacy Medal and premium to the inventors, Messrs. Blondel and Psaroudaki. In a smaller pamphlet of recent issue the same company gives some practical hints on lighting and illumination. It contains 50 original diagrams from tests.

PRESSES AND DIES.—Catalogue No. 14 of the Ferracute Machine Company, Bridgeton, N. J., just issued, describes and illustrates the full line of machinery manufactured by this concern. The presses and dies are classified in the following order: Cutting presses for thin metals, punching presses, general line of drawing presses, both single and double action; coining presses, and the large "S" presses. Several new designs are shown, and the company is now building some very large presses which are also illustrated. The illustrations convey an idea of massiveness and power in these machines, and show their construction very clearly. A most commendable feature is the large size of the illustrations, which permits a clear delineation of details—a matter of much importance when one contemplates purchasing machines of this character. The cuts in much of the trade literature are in many cases reduced to such an extent that it is a difficult, if not impossible, task to judge of the construction of the machines or apparatus so illustrated, but this charge cannot be supported in this instance. The catalogue is a large one, being 7½x11 inches, thus giving ample room to illustrate the machines in the clearest manner possible. Electrical machinists will be interested in this catalogue.

THE CENTRAL ELECTRIC COMPANY, of Chicago, reports large sales of the well known Okonite wire, for which it is sales agents. The Central Company carries a large stock of this brand, as well as cheaper grades of rubber covered wire; also double galvanized telephone, bare copper, and other wires.

Record of Electrical Patents

UNITED STATES PATENTS, ISSUED JULY 16, 1901.

[Conducted by Wm. A. Rosenbaum, Patent Attorney, 177 Times Bldg., N. Y.]

678,369. CALLING APPLIANCE FOR TELEPHONE SWITCHBOARDS; F. R. McBerty, Downers Grove, Ill. App. filed June 17, 1898. Comprises an electromagnetic helix and means controlled in making connection with the line for exciting the helix, a switch actuated by the helix for applying current to the line, a second electromagnet helix controlled by current in the line determined by a change in the resistance of the line, and a switch actuated for disconnecting the source of calling current.

678,377. MOTOR GEAR CASE FOR ELECTRIC CARS; W. Cox, Toronto, Canada. App. filed Dec. 6, 1900. A flexible gear case made in two parts and consists of resilient frames covered with canvas or the like.

678,386. ELECTRIC ARC LAMP; W. H. Fitzhurg, Bay City, Mich. App. filed May 11, 1901. Relates to means whereby open arc lamps of ordinary type may be converted into inclosed arc lamps.

678,394. TELEGRAPHIC INSTRUMENT; J. J. Ghegan, Newark, N. J. App. filed Feb. 26, 1900. Provides means for adjusting the operating position of the armature relative to the magnet in view of varying current conditions.

678,395. TELEGRAPHIC INSTRUMENT; J. J. Ghegan, Newark, N. J. App. filed April 16, 1900. See preceding patent.

678,410. ELECTRICALLY HEATED TOOL; Harry W. Leonard, East Orange, N. J. App. filed April 23, 1900. (See Current News and Notes.)

678,426. ELECTRIC CLOCK; E. Rosi, Arquata-Acrivia, G. Vacotti, Serravalle-Scrivia, Italy. App. filed Dec. 19, 1898. Details.

678,436. STORAGE BATTERY; David P. Perry, Chicago, Ill. App. filed May 7, 1900. The positive element consists of perforated disks, between each pair of which is interposed active material. The negative element is built up of rings, thus forming a hollow cylinder which is in coaxial relation with the cylinder constituting the positive element. A porous non-conducting material is interposed between each pair of the disks, which are provided with passages for the circulation of the electrolyte.

678,443. STORAGE BATTERY; William Joseph Still, of Toronto, Canada. App. filed March 24, 1899. The electrode consists of a U-shaped plate, one side of which is solid, and the two other sides slitted comb-like with the teeth twisted so as to lie at right angles to the plane of the body portion of the plate; the active material is interposed between these teeth or fingers.

678,446. INCLOSED ARC LAMP; E. P. Warner, Chicago, Ill. App. filed April 30, 1900. Relates to an inclosed arc electric lamp and more particularly to an improvement in means for controlling the ingress and egress of air and gas to and from the arc chamber.

678,475. ELECTRIC SIGNALING SYSTEM; H. G. Carleton, New York, N. Y. App. filed Sept. 29, 1900. An electrically controlled signaling system having a plurality of signaling instruments, each having a starting mechanism, a receiver, a selector, circuit connections controlled by the selector whereby each of the signaling instruments may be independently connected with the receiver, and whereby the selector operates the starting mechanism of each instrument, and means for preventing the receiver from being connected to more than one instrument at a time.

678,482. ELECTRIC ARC LAMP; J. H. Hallberg, New York, N. Y. App. filed Nov. 13, 1900. Details for an alternating current "inclosed-arc" lamp.

678,483. ELECTRIC ARC LAMP; J. H. Hallberg, New York, N. Y. App. filed Nov. 13, 1900. Details for an "inclosed-arc" lamp.

678,492. ELECTRIC SWITCH; C. A. Hussey, New York, N. Y. App. filed Nov. 1, 1900. Consists in a novel construction of a switch adapted to throw one of two filaments or branch circuits into a line circuit singly or to throw both of said filaments or branch circuits into the line-circuit in series or in multiple at will, and also to break the line-circuit at both line terminals of the switch each time the switch is operated to change the manner of connection of such filaments to the line circuit, and before the circuit is broken at the circuit changing contacts of the switch, so as to avoid arcing at such circuit changing contacts.

678,505. TELEGRAPHIC TRANSMITTING RECEIVING AND TRANSLATING ARRANGEMENT; A. Muirhead, Shortlands, Eng. App. filed Sept. 5, 1900. An automatic telegraph transmitter comprising a main driving shaft, a friction drive mounted thereon, an electromagnetically actuated pawls governing the movements of the main driving shaft, contact levers, electromagnetically actuated pawls governing the movements of the contact levers, and means serving, at will, to retain all the said pawls out of engagement.

678,509. LONG-DISTANCE RELAY MAGNETIC TELEPHONE; Jacques Nessel and Jean Frederic Gouin, of Brest, France. App. filed April 14, 1900. (See Current News and Notes.)

678,512. STORAGE BATTERY; David P. Perry, Chicago, Ill. App. filed May 7, 1900. A perforated tube has a terminal conductor arranged helically along its surface and the active material is confined between this tube and an inner tube also in contact with the helically arranged conductor.

678,517. ELECTRIC ARC LAMP; W. E. Ritter, Cincinnati, Ohio. App. filed March 21, 1901. Relates to means for supporting the electrodes and connecting them with the circuit, and also to means for regulating the movements of the upper carbon.

678,518. VARIABLE PRESSURE ELECTRIC CURRENT TRANSFORMER; Conrad J. Ritzer, Schenectady, N. Y. App. filed March 11, 1901. The transformer has the form of a ring, and the secondary winding consists of an exposed spirally-wound strip of copper. By means of a contact on an arm having its axis concentric to the ring, any desired number of turns of the secondary may be maintained in circuit.

678,522. ELECTRICALLY HEATED COOKING UTENSIL; M. Seips, Meriden, Conn. App. filed Dec. 8, 1900. An electrically heated cooking utensil comprising a receptacle portion having an annular depending flange, a heater portion comprising a top plate and means to heat the same, a supporting frame therefor, and an annular jacket carried by the frame and projecting upwardly and around the flange.

678,526. APPARATUS FOR THE RECOVERY OF GOLD FROM CYANIDE SOLUTIONS; Charles B. Stewart, of Oakland, Calif. App. filed Oct. 15, 1900. The precious metal contained in cyanide solutions is electrolytically precipitated during the flow of the solution; designed for the treatment of solutions containing a low grade or refractory metal.

678,544. ELECTRIC LIGHT WIRE MOLDING; F. H. Corduan, Brooklyn, N. Y. App. filed Dec. 29, 1899. Specific form of wooden molding.

678,559. CURRENT COLLECTOR OR TROLLEY FOR ELECTRIC RAILWAYS; W. Grunow, Jr., Bridgeport, Conn. App. filed April 22, 1901. A compound current collector or shoe for an electric railway consisting of two or more parts located in alignment with each other and means for varying the working contacting surface of said shoe at will.

678,560. ELECTRIC ARC LAMP; J. H. Hallberg, New York, N. Y. App. filed Nov. 13, 1900. Relates to details of "inclosed arc" lamps.

678,607. ELECTRIC ARC LAMP; J. J. Wood, Fort Wayne, Ind. App. filed Dec. 14, 1900. Relates principally to arc-striking and carbon feeding devices.

678,608. MAGNETIC PUZZLE; J. L. Woolf, New York, N. Y. App. filed May 31, 1901. Relates to a puzzle employing an ordinary needle as an armature in connection with a toy permanent magnet and whose solution depends on the removal of the needle from the interior of a closed box.

678,617. GUIDING DEVICE FOR TROLLEYS; A. J. Griffin, New York, N. Y.. App. filed Nov. 6, 1900. Guides pivoted on either side of trolley wheel are weighted so as to maintain a normal vertical position. Contact with obstructions deflects guides to horizontal position.

678,646. ROTOR FOR ALTERNATING-CURRENT GENERATORS; Ernst Danielson, of Stockholm, Sweden. App. filed Oct. 12, 1900. The rotor consists of a solid disk with a V groove in its periphery; the disk being tapered from the center to the periphery so that half of it has a triangular cross section.

678,655. LAMP; C. E. Gervais, New York, N. Y. App. filed Dec. 8, 1900. Combines with a lamp adapted to burn oil, a battery adapted to heat a coil and ignite a primary wick. Upon the flame being communicated to the illuminating wick the current from battery will be broken.

678,664. ELECTRIC MOTOR CONTROLLER; D. J. Hauss, Cincinnati, Ohio. App. filed March 5, 1901. Improvements in various details.

678,677. ELECTRIC SIGN; T. E. Murray, New York, N. Y. App. filed April 19, 1901. Comprises parallel conductors and lamp holders, each having as one terminal a hook whereby it may be suspended from a given conductor and as the other terminal a contact piece adapted to bear against the adjacent conductor.

678,706. ELECTRICAL MEASURING INSTRUMENT; E. Weston, Newark, N. J. App. filed Dec. 18, 1899. As an article of manufacture a frame or spool and a coil wound thereon, said parts being supported by a detachable or removable core.

678,722. REVERSIBLE GALVANIC BATTERY; Thomas A. Edison, of Llewellyn Park, N. J. Original app. filed March 1, 1901; divided June 20, 1901. (See page 134.)

678,746. METHOD OF TELEGRAPHING, INDICATING TIME OR ACTUATING MECHANISM ELECTRICALLY; C. R. Loubery, Paris, France. App. filed July 9, 1900. A series of relays are employed and means are provided for impressing on the circuit of the relays currents of different frequencies, which are adapted to selectively operate the relays, which in turn are adapted to actuate appropriate mechanisms for giving signals, etc.

678,760. CIGAR CUTTER AND LIGHTER; L. P. Perew, North Tonawanda, N. Y. App. filed Jan. 30, 1900. Each operation of the lighter causes a new advertisement to appear before the window in the casing.

678,782. ELECTRODE FOR WATER HEATERS; H. M. Hill, St. Louis, Mo. App. filed Oct. 25, 1900. The electrode has a fabric covering, whose map is embedded in the electrode to serve as a binder therefor.

678,787. MARINE FIRE INDICATING SYSTEM; F. W. Meyer, Jersey City, N. J. App. filed Sept. 28, 1900. Tubes leading from various parts of the vessel to a station are connected with a suction device operated periodically. Smoke issuing from the tubes indicates fire.

678,803. DEVICE FOR THE PRODUCTION OF CONTINUOUS CURRENT IN REGULAR PULSATIONS; E. V. Haanen, Vienna, Austria-Hungary. App. filed Jan. 19, 1901. Consists of a condenser located in a shunt of the line circuit, the latter being provided with an adjustable resistance and the shunt circuit being provided with a variable spark-producer.

678,816. PROCESS OF RECOVERING ZINC; Albert J. Shinn, of Philadelphia, Pa. App. filed June 4, 1900. The zinc is deposited electrolytically from a solution of its salt or other compounds, on a moving cathode of mercury, the process being continuous.